Dissertation On

THE CORRELATION BETWEEN PROPORTIONAL PULSE PRESSURE AND EJECTION FRACTION IN HEART FAILURE PATIENTS

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ENDORSEMENT BY THE DEAN/
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This is to certify that this dissertation titled "**THE CORRELATION BETWEEN PROPORTIONAL PULSE PRESSURE AND EJECTION FRACTION IN HEART FAILURE PATIENTS"** submitted by Dr.A.P.Janani, appearing for M.D Degree Branch – 1, GENERAL MEDICINE examination in April 2016 is a bonafide record of work done by her in partial fulfilment of the regulations of The Tamilnadu Dr. M.G.R Medical University, Chennai. I forward this to the Tamilnadu Dr. M.G.R Medical University, Chennai, Tamilnadu, India.

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I solemnly declare that this dissertation entitled **"The correlation between proportional pulse pressure and ejection fraction in heart failure patients "** has been conducted by me at ESIC MedicalCollege & PGIMSR, Chennai, under the guidance and supervision of **Prof.Dr.A.R.Malathy, M.D.**, Professor and Head,Department of General Medicine, ESIC Medical College & PGIMSR, Chennai-78. This dissertation is submitted to **The Tamil Nadu Dr. M.G.R. Medical University, Chennai** in partial fulfilment of the University regulations for the award of the degree of **M.D. Branch 1 (General Medicine)**.

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LIST OF ABBREVIATIONS

1. HF- Heart Failure
2. PPP – Proportional Pulse Pressure
3. EF – Ejection Fraction
4. SBP – Systolic blood pressure
5. DBP –Diastolic blood pressure
6. TPR –Total peripheral resistance
7. MI – Myocardial infarction
8. PP – Pulse pressure
9. CAD – Coronary artery disease
10. HFrEF – Heart failure with reduced ejection fraction
11. HFpEF – Heart failure with preserved ejection fraction
12. JVP – Jugular venous pressure
13. S3 – Third heart sound
14. CTR – Cardio thoracic ratio
15. BNP – Brain natriuretic peptide
16. OR – Odds ratio

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“THE CORRELATION BETWEEN PROPORTIONAL PULSE PRESSURE AND EJECTION FRACTION IN HEART FAILURE PATIENTS”

Author: A P JANANI, A R MALATHY.

ABSTRACT

OBJECTIVE:

To study the correlation between proportional pulse pressure and ejection fraction in heart failure patients and the prognostic value of proportional pulse pressure in a patient with heart failure.

RESULTS:

Highly significant (p value <0.001) association observed between ejection fraction and breathlessness on exertion, orthopnea, elevated jugular venous pressure, proportional pulse pressure, systolic blood pressure, pulse pressure, third heart sound and basal crepitation. The association is more (Pearson chi square value is 72.11) for pulse pressure as compared to other parameter. The correlation of proportional pulse pressure, systolic blood pressure, and pulse pressure with ejection fraction showed moderate positive correlation in initial assessment. During follow up moderate positive correlation for proportional pulse pressure was maintained. The correlation of systolic blood pressure and pulse pressure with ejection fraction was increased to strong positive correlation. The correlation coefficient regression line was linear positive for all the three parameters. After optimization of treatment, the improvement in proportional pulse pressure correlates with increased ejection fraction.

CONCLUSION:

The proportional pulse pressure showed moderate positive correlation with ejection fraction. The proportional pulse pressure had good specificity for detecting patients with heart failure with reduced ejection fraction. The proportional pulse pressure was a good prognostic indicator in heart failure patients, low proportional pulse pressure associated with poor outcome.

KEY WORDS: pressure, pulse pressure, blood pressure, proportional pulse pressure, ejection fraction, heart failure

AIM OF THE STUDY

The correlation between proportional pulse pressure and ejection fraction by 2D Echocardiogram in heart failure patients.

Objectives:

1. To study the correlation between proportional pulse pressure and ejection fraction in heart failure patients.

2. To study the prognostic value of proportional pulse pressure in a patient with heart failure.

INTRODUCTION

A common clinical syndrome with raising incidence and prevalence is Heart failure (HF). Countless large clinical trials done over the use of pharmacological therapy and devices has resulted in a raising use of evidence based therapy in heart failure management. In spite of these advances the morbidity and mortality of heart failure patients endures to stay high. Adherence to guidelines results in enhanced outcomes of heart failure patients. Evidence based therapy is the important milestone in successful heart failure management for caregivers [1].

DEFINITION:

The American Heart Association / American College of Cardiology guidelines, heart failure is defined as “a complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill or eject blood” [1, 2]. The guidelines underscore that “it is mainly a clinical diagnosis that is based on a careful history and physical examination”. The word “heart failure” is preferred over “congestive heart failure” because not all the heart failure patients had volume overload.

INCIDENCE AND PREVALANCE:

The overall prevalence of heart failure in the adult population in developed countries is 2 %.It prevalence follows an exponential outline and rising with age. It affects 6-10% of people over the age of 65years. The relative incidence of heart failure is lower in women in difference to men. Because of their longer life expectancy, women constitute one half the case of heart failure. The prevalence of heart failure is believed to be increasing in portion because of current therapies for cardiac disease and enable patients to survive longer [4].

CLASSIFICATION:

Heart failure was beforehand thought to arise in the setting of a depressed left ventricular ejection fraction. Though, epidemiologic studies clarified that approximately nearly half of patients who develop heart failure have a normal or preserved ejection fraction (EF ≥50%) [1].

Accordingly, the historical words “systolic” and “diastolic” HF have been abandoned. Now heart failure patients broadly categorized

1. HF with a reduced EF (HFrEF; formerly systolic failure)
2. HF with a preserved EF (HRpEF; formerly diastolic failure)

NYHA CLAAIFICATION:

Class	Patient Symptoms
Class I (Mild)	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, or dyspnea (shortness of breath).
Class II (Mild)	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, or dyspnea.
Class III (Moderate)	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, or dyspnea.
Class IV (Severe)	Unable to carry out any physical activity without discomfort. Symptoms of cardiac insufficiency at rest. If any physical activity is undertaken, discomfort is increased.

ETIOLOGIES OF HEART FAILURE

Each condition which leads to an alteration in left ventricular structure or function can predispose patients to develop heart failure. Even though the etiology of heart failure in patients with a preserved ejection fraction differs from that of patients with reduced ejection fraction, there is substantial overlap between the aetiologies of these two conditions [1].

Reduced Ejection Fraction (<40%):

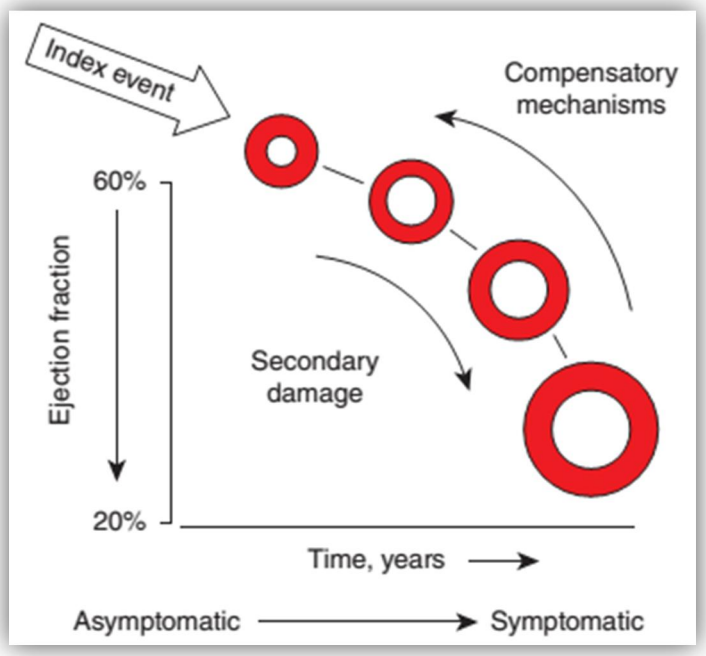
Coronary artery disease	• Myocardial infarction • Myocardial ischemia
Chronic pressure overload	• Obstructive valvular disease • Hypertension
Chronic volume overload	• Regurgitantvalvular disease • Intra cardiac shunting • Extracardic shunting
Chronic lung disease	• Corpulmonale • Pulmonary vascular disease • Pulmonary embolism
Non ischemic dilated cardiomyopathy	• Familial/genetic disorder • Infiltrative disorder • Metabolic disorder • Viral • Chagas disease
Toxin / drug induced	• Alcohol • Cocaine • Radiation
Disorder of rate and rhythm	• Tachycardia • Bradycardia • Heart block

Preserved Ejection Fraction (EF>40 – 50%):

Pathologic hypertrophy	High-output states
➢ **Primary** Hypertrophic cardiomyopathy ➢ **Secondary** 1. Hypertension 2. Restrictive cardiomyopathy (amyloidosis, sarcoidosis) 3. Infiltrative disorder 4. Endomyocardial disorder	• Metabolic disorder – thyrotoxicosis • Nutritional disorder (beribery) • Systemic AV shunting) • Chronic anemia.

PATHOPHYSIOLOGY

In response to a sequence of complex events that occur at the cellular and molecular levels results in left ventricular remodelling is the basic pathophysiology of heart failure with reduced ejection fraction. Current studies have shown that left ventricular remodelling can be reversed following medical and device therapy and that reversed left ventricular remodelling is associated with improved clinical outcomes in patients with heart failure with reduced ejection fraction. Indeed, one of the aims of therapy for heart failure is to prevent and/or reverse left ventricular remodelling[1].



Fig;1

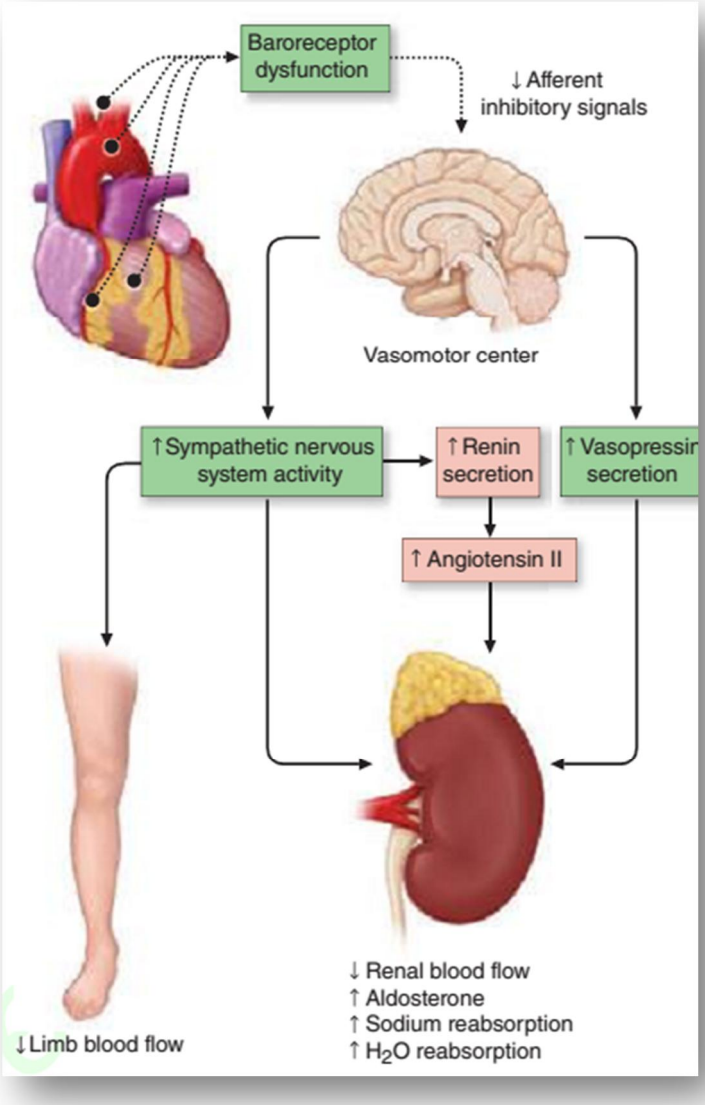


Fig. 2

The compensatory mechanisms are,

(1) Activation of the renin-angiotensin-aldosterone (RAA) and adrenergic nervous systems, which are responsible for maintaining cardiac output across increased retention of salt and water (Fig.2) and increased myocardial contractility.

(2) Activation of a family of countervailing vasodilatory molecules, including the atrial natriuretic peptide and brain natriuretic peptide, prostaglandins (PGE2and PGI2), and nitric oxide (NO), that results in stopping the excessive peripheral vascular vasoconstriction[1].

CLINICAL HISTORY AND EXAMINATION

The cardinal symptoms of heart failure are fatigue and shortness of breath. In the early stages of heart failure, dyspnoea is noted only during exertion. Though, as the illness progresses, dyspnoea occurs with less strenuous activity, and it in the end may occur even at rest. The basis of dyspnoea in heart failure is plausibly multifactorial. The most vital mechanism is pulmonary congestion with accumulation of interstitial or intra-alveolar fluid, which activates juxta capillary J receptors, which in coil stimulate the rapid, shallow breathing which is characteristic of cardiac dyspnoea.

Orthopnoea (shortness of breath after lying flat) and paroxysmal nocturnal dyspnoea (sudden onset of nocturnal shortness of breath) are both manifestations of heart failure precipitated by increased venous return. The other clinical parameters are elevated jugular venous

pressure (JVP), peripheral oedema, palpable liver, basal crepitation, tachycardia, and a third heart sound. Nocturia is common in heart failure will results in insomnia.

A short overview of certain terminologies is as follows;

DYSPNEA:

Dyspnoea is an atypical awareness of breathing occurring at rest and/or minimal exertion. It is a subjective experience perceived and reported by an affected patient. Dyspnoea on exertion (DOE)may occur normally, but is considered as symptom of heart diseasewhen it occurs at a level of activity that is well tolerated usually [3].

ORTHOPNEA:

Orthopnoea is described as dyspnoea occurring in the recumbent position, and it is relieved by sitting or standing. In recumbent position of heart failure patients causes an increases in left atrial pressure, and there by resulting in pulmonary congestion and severe dyspnoea [3].

PAROXYSMAL NOCTURNAL DYSPNOEA:

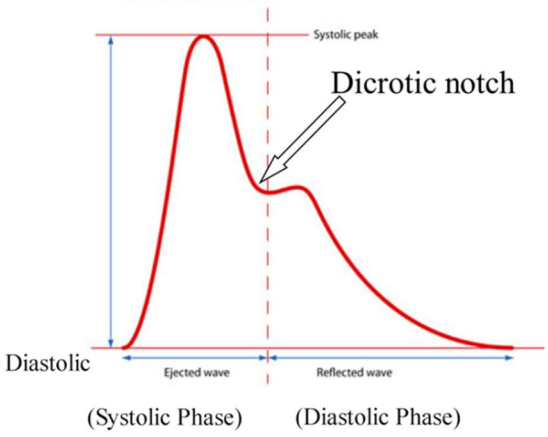
Defined as acute episodes of severe shortness of breath and coughing that usually occur at night and awaken the patient from nap, normally 1–3 h afterward the patient sleeps. Cardiac asthma is closely related to paroxysmal nocturnal dyspnoea[3].

EDEMA:

Edema is difined as collection excess amount of fluid in the intra vascular or interstitial space. Conventionally, it is divided into pitting and non pittingedema. Pitting edema is the important feature in heart failure. It is usually examined in dependent area, over the bony prominence.

PULSE:

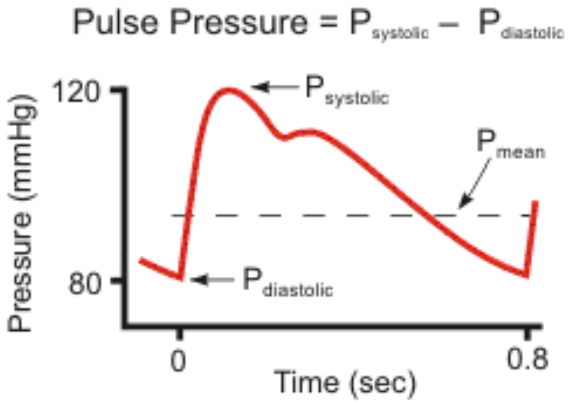
It is the pressure wave that travels alongside the walls of arteries when blood is ejected from left ventricle into aorta across systole resulting in expansion of artery that is palpated as arterial pulse. The transmission of pressure pulse wave is independent to velocity of blood flow and much faster than it. Normally arterial pulse ends in arterioles and there are no capillary pulsations. Except jugular vein, no pulsations in other veins. The amplitude of arterial pulse generally depends on pulse pressure[3].



BLOOD PRESSURE:

Blood pressure (BP) is the pressure, measured by sphygmo-manometry as millimetres of mercury. It is divided in to systolic blood pressure and diastolic blood pressure. Systolic blood pressure is the pressure measured during peak of contraction of left ventricle. And, the diastolic blood pressure is the pressure measured during end of ventricular diastole. Systolic blood pressure mainly depends on stroke volume and diastolic blood pressure mainly depends on peripheral vascular resistance. In old age due to loss of elasticity of vessels results in decrease in peripheral vascular resistance and there dy low diastolic blood pressure. In acute shock, blood loss, and acute left ventricular failure decrease in stroke volume results in low systolic blood pressure.

PULSE PRESSURE:



Pulse pressure = Systolic blood pressure – Diastolic blood pressure

- It is the difference between systolic blood pressure and diastolic blood pressure. It depends on Stroke volume and Elasticity of arteries.
- Pulse pressure is directly proportional to stroke volume.
- Stroke volume is affected by heart rate, total peripheral resistance (TPR) & mean systemic filling pressure.
- Stroke volume is decreased with increased heart rate.

TOTAL PERIPHERAL RESISTANCE:

The rise in total peripheral resistance results in constriction of arterioles leads to less blood flows to tissues and there by decrease in venous return and stroke volume.

MEAN SYSTEMIC FILLING PRESSURE:

Mean systemic filling pressure is directly proportional to venous return. If this pressure increases lead on to increase in venous return results in increases Stroke volume.

ELASTICITY OF ARTERIES:

Pulse pressure is inversely proportional to elasticity of arteries. In more elastic arteries pulse pressure decreases. With aging, arteries are become less elastic resulting in high pulse pressure.

PROPORTIONAL PULSE PRESSURE:

It is a ratio of pulse pressure and systolic blood pressure.

$$\text{Proportional pulse pressure (In percentage)} = \frac{\text{Pulse pressure}}{\text{Systolic blood pressure}} \times 100$$

Proportional pulse pressure showed good correlation with cardiac index & stroke volume compared to pulse pressure. When proportional pulse pressure was less than 25 percent, it reflects a cardiac index below 2.2 lit/min/m2.

Proportional pulse pressure is a significant risk indicator in heart failure, in advanced heart failure patient whose treated optimally, its higher value related to favourable outcome and less than 25 percent related to poor outcome.

JUGULAR VENOUS PRESSURE (JVP):

It is the indirect measurement of right atrial pressure. During cardiac cycle, fluctuations in right atrial pressure produce a pulse that is conducted backwards into jugular veins. Normal jugular venous pressure is 6 mmhg which is corresponds to presence of jugular venous pulse 4 cm above the sternal angle or 9 cm above the right atrium[3].

Conditions with elevated jugular venous pressure [3] is

1. Congestive heart failure,
2. Corpulmonale,
3. Pulmonary embolism,
4. Right ventricular infarction,
5. Tricuspid valve disease,
6. Tamponed & Constrictive pericarditis.

THIRD HEART SOUND:

The third heart sound (S 3) is a low-frequency, brief vibration occurring in early diastole due to rapid filling of right or left ventricle (S3) following atrio ventricular valve opening. “S3 is physiological in children and young adults but usually disappears after the age of 40[3]. It also occurs in high-output states caused by anaemia, fever, pregnancy and thyrotoxicosis. After the age of 40 years S3 is nearly always pathological, usually indicating left ventricular failure and less commonly, mitral regurgitation or constrictive pericarditis” by hutchinsons clinical method [3].

HEART FAILURE DIAGNOSTIC CRITERIA:

FRAMINGHAM CRITERIA:

Major criteria:	Minor criteria:
• Paroxysmal Nocturnal dyspnea or orthopnea • Neck vein distension • Pulmonary basal crepitation • Cardiomegaly (>55%) • Acute Pulmonary edema • Third heart sound • Increased venous pressure ≥16cm of water • Circulatory time ≥25 s •Hepato jugular reflux	• pedal oedema • Nocturnal cough • Dyspnoea on exertion • Hepatomegaly • Pleural effusion • Vital capacity decreased 1/3 from Maximum • Tachycardia, heart rate of≥120/min

Major or minor criteria: Weight loss ≥4.5 kg to 5kg in response to treatment.

***Heart failure present with 2major or 1major and 2minor criteria.**

BOSTON CRITERIA:

Category 1: (points)	Category 2: (points)	Category 3: (points)
History: • Rest dyspnea(4), • Orthopnea (4) • Paroxysmal nocturnal dyspnea (3) • Dyspnea on walking on level (2) • Dyspnea on climbing (1)	**Physical examination:** • tachycardia (1–2) • elevated Jugular venous Pressure (1–2) • pulmonary crepitation (1–2) • Wheezing (3) • Third heart sound (3)	**Chest radiography:** • Alveolar pulmonary edema (4) • Interstitial pulmonary edema (3) • Bilateral pleural effusions (3) • Cardiothoracic ratio ≥0.55 (3) • Upper zone Flow redistribution (2)

- Definite heart failure - 8–12 points,
- Possible heart failure 5–7 points,
- Heart failure unlikely ≤4 points

BIOCHEMICAL MARKERS IN HEART FAILURE:

The pre-pro hormone brain natriuretic peptide is a precursor of brain natriuretic peptide and N-terminal pro-brain natriuretic peptide. It contains 134-amino-acid peptide. It is produced in the myocytes and metabolised to pro hormone brain natriuretic peptide contains 108 amino acids. Pro hormone brain natriuretic peptide is metabolised by a circulating endo protease into two polypeptides: one is inactive N terminal-pro-brain natriuretic peptide and another one is a bioactive peptide brain natriuretic peptide. Brain natriuretic peptide and N-terminal-pro-brain natriuretic peptide have been used to differentiate between cardiac and non-cardiac causes of breathlessness in heart failure patients.

ELECTROCARDIOGRAPHY:

The basic investigation electrocardiography primarily used to know the etiology of heart failure and then complication of heart failure. In coronary artery disease it shows which vessel affected, in hypertensive patients it shows ventricular hypertrophy. The QRS widening i.e. more than 120 ms, is common feature in patients with dilated cardiomyopathy related heart failure (sensitivity is 30%)[2].

CHEST RADIOGRAPHY:

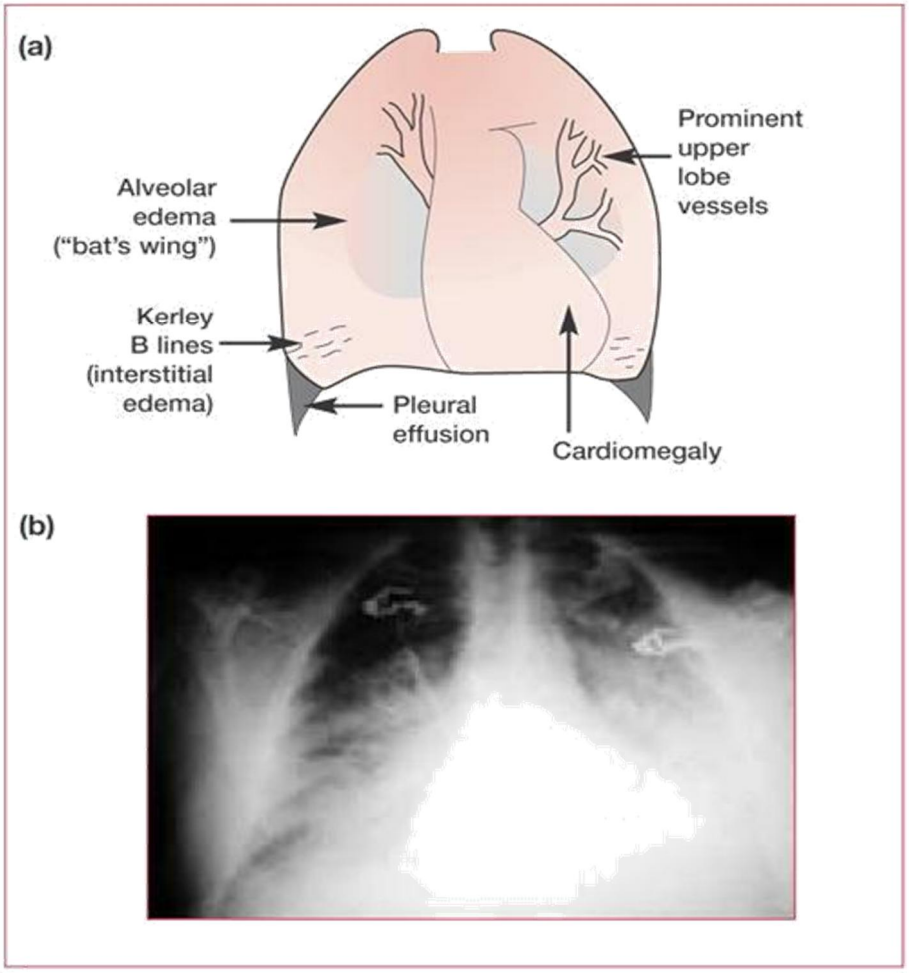


Figure 3

(A) Explains The Important Signs Of Heart Failure.

(B) Shows Cardiomegaly And Right Plural Effusion.

ECHOCARDIOGRAM:

According to American Society of Echocardiography-European Association of Echocardiography guidelines, “Echocardiogram is an important tool to assess the ventricular function and underlying structural lesion. Assessment of left ventricular systolic function in biplane Simpson’s method is routinely utilized in clinical use. It is a valuable and simple tool in measuring left ventricular volumes and assessment of stenosis and regurgitation. Echocardiography plays a vital role in the diagnosis of patients with heart failure, in part because the physical examination, electrocardiogram and / or chest radiograph do not provide information that distinguishes diastolic from systolic heart failure. Trans mitral and pulmonary flow velocities are used in the assessment of diastolic dysfunction. Variation in the pattern of these velocities gives vision into left ventricular diastolic function and prognosis. Some amount of grade I diastolic dysfunction is seen in most of the patients and it has to be correlated with the clinical symptoms and signs. It mainly helps to differentiates constrictive pericarditis and restrictive cardiomyopathies”. Echocardiogram ought to be performed in all patients with symptoms or signs of heart failure because it is a very useful, cheaper, easily available and non-invasive tool.

ROLE OF ENDOMYOCARDIAL BIOPSY (EMB):

Endo myocardial biopsy is useful in identify a behind pathology of dilated cardiomyopathies like myocarditis and cardio tropic viruses. In selected cases of infiltrative diseases to found exact aetiology of heart failure, it can be used to diagnose the cause. Endo myocardial biopsy can be done through internal jugular vein or femoral vein. It is a safe technique.

The current recommendation for indication of endo myocardial biopsy is

1. Patients with new onset of heart failure for less than three months duration,

2. Patients with haemodynamic compromise with or without dilated ventricles,

3. Evidence of arrhythmias and its fail to respond to usual tretment for 1 to 2 weeks of duration.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

This study aims to find out the correlation between proportional pulse pressure and ejection fraction in heart failure patients. Secondarily, to study the prognostic value of proportional pulse pressure in a patient with heart failure.

Although, epidemiological studies in the past decade fail to give data about importance of physical signs in patients with heart failure, the cardiovascular physical examination remains a basis for diagnosis and therapy in patients with heart failure till today in many occations.

Proportional pulse pressure in heart failure:

In 1989, Stevenson LW et al (8), compared physical signs of heart failure in patients with known chronic heart failure with ejection fraction is 18 % +/- 6 %. In this study they found when pulmonary capillary wedge pressure is greater than or equal to 22mm Hg, 18 out of 43 patients do not have crepitation, pedal oedema, and / or elevated jugular venous pressure.

Hence, these physical signs had 58% sensitivity and 100% specificity for predicting patients with heart failure. But the proportional pulse pressure correlated well with cardiac index, and when it is less than 25% proportional pulse pressure had sensitivity of 91% and specificity of 83% for cardiac index less than 2.2lit/mi n/m2.

They concluded, “In chronic heart failure patients, the reliance of physical signs for heart failure might result in inadequate therapy. Conversely, the reliance of proportional pulse pressure facilitates decisions in heart failure patients regarding treatment”.

These findings were supported by the results of Shah [12] et al., demonstrated “proportional pulse pressure was the only multivariable predictor of pulmonary capillary wedge pressure (PCWP) more than 18 mmHg (‘wet patients’) and a cardiac index of less than 2.2 L/min/m2 (‘cold patients’)”.

In a more recent study by Nohria[13] et al., also explained “event-free survival was significantly lower in the ‘wet and cold’ patients when compared with the ‘dry and warm’ patients”.

In 2001, Monica R [14]et al., did study on, “Hemodynamic profiles of advanced heart failure: Association with clinical characteristics and

long-term outcomes". In this study they classified heart failure patients into four categories according to hemodynamic profiles (symptoms, physical signs and outcomes) are

1. wet and cold,
2. wet and warm,
3. dry and cold,
4. dry and warm.

They found, "Of the physical examination variables, only a lower proportional pulse pressure was a significant multivariable predictor of the wet/cold category".

In the year of 2009,Miklos de kany[15,37] et all., studied, "Proportional pulse pressure, a new non invasive parameter with prognostic value in advanced heart failure. Therapeutic implications''. In this study they enrolled 169 patients with advanced heart failure (NYHA 3 &4) and assessed their parameters followed by optimization of treatment. They divided into two groups according to proportional pulse pressure more than 40% and less than 40%. During follow up they found that 1% increases in proportional pulse pressure resulted in 6% decrease in mortality.

From this, they concluded, “In advanced systolic heart failure treated optimally, proportional pulse pressure is a significant risk indicator, its higher values relate to a more favourable outcome. When during treatment optimization proportional pulse pressure increases, we can count on a favourable long term effect independently from changes in systolic blood pressure. Proportional pulse pressure involving both pulse pressure & systolic blood pressure is a simple parameter which can be used easily in daily clinical practice, follow up, and can help in treatment optimization”.

Pulse pressure & other clinical parameter in heart failure:

In 1993, Butmansm[17]et al., did a study on “Bedside cardiovascular examination in patient with severe chronic heart failure”. They found the presence of pulmonary crepitation, left ventricular third heart sound, elevated jugular venous pressure or hepato jugular reflex will indicate high right heart pressure and low cardiac performance. Their study yielded a sensitivity of 81% and specificity of 80% and predictive accuracy of 81% for elevation of pulmonary capillary wedge pressure greater than or equal to 18 mm hg.

The Framingham heart study - In 1999, Frankalin et al [19], did a study on “Is pulse pressure useful in predicting risk for coronary heart disease?”. They found, “coronary heart disease risk increased with lower diastolic blood pressure and any level of systolic blood pressure > or = 120 mm hg in the middle aged and elderly people”. It suggests wide pulse pressure was an important component of risk factor for coronary heart disease.

Same year, Micheal et al[20], studied, “Independent prognostic information provided by sphygmomanometrically determined pulse pressure and mean arterial pressure in patients with left ventricular dysfunction”. They found, “a non invasive blood pressure measurement provides to independent prognostic factors for survival and increased conduit vessel stiffness as accessed by pulse pressure may contribute to increased mortality in patient with left ventricular dysfunction, independent of mean artrial pressure”.

Same year, Chen YT[21] et al , studied, “Risk factors for heart failure in the elderly: a prospective community- based study.” They conclude, independent predictors of heart failure are male sex, older age, diabetes, pulse pressure greater than or equal to 70 mm Hg and body mass index greater than or equal to 28 kg/m2.

In the year of 2000, Fang J et al[22]., did a study on “Pulse pressure: a predictor of cardiovascular mortality among young normotensive subjects.” They found, Wide pulse pressure is better predictor of cardiovascular disease events in hypertensive patients compared to systolic blood pressure, diastolic blood pressure and mean arterial pressure. In conclusion, “among young subjects, but not older normotensive persons, at very low risk of cardiovascular disease, a wide pulse pressure is associated with increased cardiovascular mortality”.

In the same year Viola Vaccarino et al[23], did a study on “Pulse Pressure and Risk for Myocardial Infarction and Heart Failure in the Elderly” also concluded the same.

In the same year, Glynn RJ et al[24], did a study on “Pulse pressure and mortality in older people.” They conclude, “Pulse pressure appears to be the best single measure of blood pressure in predicting mortality in older people and helps explain apprarently discrepant results for low diastolic blood pressure”.

In the year of 2001, Colin J Petrie et al[25]., did study on, “Low Pulse Pressure Predicts Mortality In Patients With Left Ventricular Dysfunction Post Myocardial Infarction, But Only In Those With Signs

And Symptoms Of Heart Failure". In this study, they conclude, "A low pulse pressure is an independent predictor of mortality in subjects with depressed left ventricular ejection fraction after myocardial infarction and signs and symptoms of heart failure". These results were supported by recently published data of a lower pulse pressure as an adverse predictor in patient with heart failure.

In the same year, Roland Asmar et al[26]., studied about "Pulse Pressure" and they conclude, "on the basis of large scale intervention trials, pulse pressure seems to be an appropriate tool for studies of clinical pharmacology and therapeutics in the fields of hypertension, congestive heart failure and other cardiovascular diseases".

In 2004, Stanley S. Franklin et al[24]., studied, "A low pulse pressure is an independent predictor of mortality in heart failure". They analysed prognostic role of pulse pressure in patients with heart failure. They concluded, "For any given level of mean arterial pressure, a low pulse pressure is an independent predictor of cardiovascular death in patients with heart failure".

In the year of 2009, Colin J.Petrie et al [25]., did a study on “Low pulse pressure is an independent predictor of mortality and morbidity in non ischaemic, but not in ischaemic advanced heart failure patients”. From this study they found, “Low pulse pressure is a readily obtainable risk marker of death in advanced non ischaemic heart failure. Mean arterial pressure remains an important component of blood pressure in predicting mortality, especially in those with heart failure of ischaemic aetiology”.

In the year of 2011, Colin J.Petrie et al [26]., studied, “A low pulse pressure predicts mortality in subjects with heart failure after an acute myocardial infarction: a post-hoc analysis of the CAPRICORN study”. A low pulse pressure is predictive factor for adverse cardiovascular events in patients with advanced heart failure. They studied “The prognostic importance of pulse pressure in a group of post-myocardial infarction patients, with and without signs and symptoms of heart failure”. From this they concluded “A low pulse pressure is an independent predictor of mortality in subjects with depressed left ventricular ejection fraction after a recent myocardial infarction and evidence of Killip Class II–IV heart failure”.

In the year of 2015, TakanoriTokitsu et al[31]., did a study on, "Clinical significance of pulse pressure in patients with coronary artery disease" This study demonstrated that coronary artery disease patients with a combination of high pulse pressure with low ankle brachial index had the highest risk of cardiovascular events, suggesting that combining ankle brachial index to pulse pressure value could be a more precise cardiovascular risk predictor in coronary heart disease patients. Ankle brachial reflex measurement and pulse pressure could be an important non-invasive parameters of identifying patients with poor prognosis. This study provides the stronger prognostic significance of pulse pressure than other blood pressure parameters in coronary heart disease patients. In addition, combining pulse pressure to ankle brachial reflex values might further enhance the prediction of cardiovascular risks.

In 2015, Colette E. Jackson, et al[32]., did a study on "Differing prognostic value of pulse pressure in patients with heart failure with reduced or preserved ejection fraction: results from the MAGGIC individual patient meta-analysis". They conclude "lower pulse pressure (especially <53 mmHg) was an independent predictor of mortality in patients with heart failure (HF) with reduced ejection fraction (HF-REF), particularly in those with an LVEF < 30% and systolic blood

pressure <140 mmHg, but this relationship between pulse pressure and outcome was not consistently observed among patients with preserved ejection fraction (HF-PEF)".

Electrocardiographic changes in heart failure:

In the year of 2005, Miyoshi F et al., [27] did a study on "Prolonged QRS duration as a predictor for congestive heart failure". They observed QRS duration was significantly prolonged during the follow up of patients with heart failure ($P < 0.05$), but did not change in patients without heart failure.

In the year 2006, Dhingra R et al., [33] did a study on "Electrocardiographic QRS duration and the risk of congestive heart failure: the Framingham Heart Study". They found "longer electrocardiographic QRS was associated with increased heart failure risk, consistent with the hypothesis that depolarization delay may increase heart failure risk".

In the same, Peter M.okin et al[34]., did a study on "Electrocardiographic Strain Pattern and Prediction of New Onset Congestive Heart Failure in Hypertensive Patients" and they observed "ECG strain identifies hypertensive patients at increased risk of

developing heart failure and dying due to heart failure, even in the setting of aggressive blood pressure lowering".

In 2005, Adriaan A et al[25]., studied, "Low pulse pressure is independently related to elevated natriuretic peptides and increased mortality in advanced chronic heart failure". In this study, they found, "Pulse pressure provides a readily available, clinical or bedside prognostic indicator in advanced heart failure. Low pulse pressure independently predicts increased mortality. Moreover, low pulse pressure is independently related to increased natriuretic peptides".

In the year of 2005,Assmann G et al[26], did a study on "Importance of arterial pulse pressure as a predictor of coronary heart disease risk in PROCAM". They observed, increases of 10 mmHg in pulse pressure were associated with an increased risk of coronary heart disease. Over all , they conclude, "coronary artery disease risk in men with pulse pressure > or =70 mm hg was more than three times that of men with pulse pressure <50 mm hg".

In 2006, Alejandro de la Sierra et al[28]., studied, " Value of pulse pressure as a cardiovascular risk marker". They found, " Pulse pressure reduction by antihypertensive treatment in subjects with elevation of this

parameter (isolated systolic hypertensive) protects against cardiovascular disease". The limitation in this study, "the independence of this protection regarding other blood pressure components or the existence of clear differences between antihypertensive drug classes on pulse pressure reduction is still unknown".

MATERIALS AND METHODS

MATERIALS AND METHODS

Place of study:

DEPARTMENT OF GENERAL MEDICINE,

ESIC MEDICAL COLLEGE & PGIMSR,

K.K. NAGAR,

CHENNAI - 78

Study design:

Analytical, longitudinal study

Study period:

12months

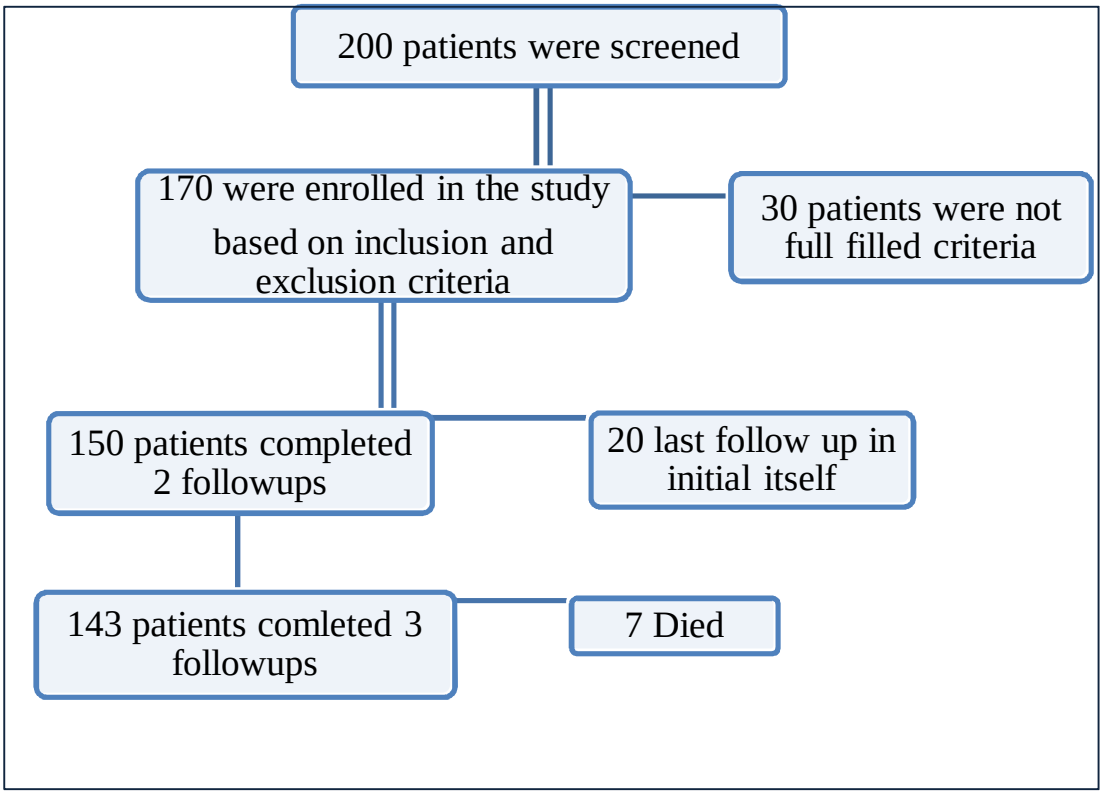
Inclusion criteria:

- Patients aged 18 – 75 years with symptoms and signs of heart failure

Exclusion criteria:

- Age less than 18 years ,
- Age more than 75 years,
- Patient with vavular heart disease, pericardial diseases
- Patients with heart failure secondary to pulmonary disease

Study Population:



All patients with symptoms and signs of heart failure admitted to then department of general medicine, ESIC medical college &PGIMSR, were enrolled in the study. An informed consent was obtained from the patients. A detailed history was recorded along with complete clinical examination as in a proforma. Provisional diagnosis was the one made and this was subsequently revised after completion of the investigations.

PARAMETERS

1. Jugular venous pressure
2. Peripheral oedema
3. Blood pressure
4. Pulse pressure
5. Proportional pulse pressure
6. Third heart sound
7. Basal crepitation
8. Ejection fraction by ECHO

METHADOLOGY

The study population were assessed with detailed clinical history and basic clinical examination. Concentrated on presence of elevated jugular venous pressure, pedal edema, third heart sound, basal crepitation and blood pressure measurement according to standard protocol.

MEASUREMENT OF BLOOD PRESSURE:

Blood pressure was measured by sphygmo-manometry. A aneroid manometer with cuff of at least 80% the arm circumference in width is used and inflated around the extended arm .

American Heart Association Guidelines for Blood Pressure Measurement:

RECOMMENDATION	*COMMENTS*
Patient should be seated comfortably, with back supported, legs uncrossed, and upper arm bared.	Diastolic pressure is higher in the seated position, whereas systolic pressure is higher in the supine position.
	An unsupported back may increase diastolic pressure; crossing the legs may increase systolic pressure.
Patient's arm should be supported at heart level.	If the upper arm is below the level of the right atrium, the readings will be too high; if the upper arm is above heart level, the readings will be too low.
	If the arm is unsupported and held up by the patient, pressure will be higher.
Cuff bladder should encircle 80 percent or more of the patient's arm circumference.	An undersized cuff increases errors in measurement.
Mercury column should be deflated at 2 to3 mm per second.	Deflation rates greater than 2 mm per second can cause the systolic pressure to appear lower and the diastolic pressure to appear higher.
The first and last audible sounds should be recorded as systolic and diastolic pressure, respectively. Measurements should be given to the nearest 2 mm Hg.	
Neither the patient nor the person taking the measurement should talk during the procedure.	Talking during the procedure may cause deviations in the measurement.

Auscultation over the brachial artery provides five phases of Korotkoff sounds as the cuff is deflated:

Phase 1 - The first appearance of the sounds = SYSTOLIC BLOOD PRESSURE

Phase 2&3 - The increasing loud sounds

Phase 4 - Abrupt muffling of the sounds

Phase 5 - Disappearance of the sounds = DIASTOLIC BLOOD PRESSURE

From this measurement pulse pressure was calculated by following formula.

Pulse pressure = Systolic blood pressure – Diastolic blood pressure.

And proportional pulse pressure is calculated by using following formula.

$$\text{Proportional pulse pressure (In percentage)} = \frac{\text{Pulse pressure}}{\text{Systolic blood pressure}} \times 100$$

MEASUREMENT OF ECHOCARDIOGRAPHY

All echocardiographic measurements were obtained with the patients at rest. The standard echocardiographic examination were performed by an AcusonSequoia^{TM} ultrasound machine with a 3.5-MHz phased-array transducer.

M-mode and two dimensional echocardiography were performed by experienced cardiologist. And standardized imaging protocol have been adopted with cross sectional imaging of left ventricle (immediately distal to the mitral valve tip). M-mode measurements were applied “the leading edge to leading edge” principle as recommended by the American Society of Echocardiography(ASE).

Ejection fraction was calculated from the end diastolic volume and the end systolic volume, using the following formula:

$$\text{Ejection Fraction} = \frac{\text{End diastolic Volume} - \text{End Systolic Volume}}{\text{End diastolic Volume}}$$

STATISTICAL ANALYSIS

The clinical parameters of heart failure were compared and analysed using pearson chi square method. The diagnostic accuracy of all the parameters was then compared and interpreted with reference to clinical data.

In the present study, the statistical methods were for quantitative data, descriptive statistics was presented by N, Mean, Standard Deviation and Range. For qualitative data, frequency count, N and percentage were put in a tabular manner.

To analyze the data, an appropriate statistical test was applied so as to find the association between parameters, Chi square test (2x2 cross tabulation) was used. Screening tests such as Sensitivity, specificity have been calculated.

All the statistical analysis has been done by using statistical software SPSS (version 16.0). Other data, displayed by various tables and charts, by using Microsoft excel (windows 8).

* Significant - $p < 0.05$
** Very significant - $p < 0.01$
*** Highly significant - $p < 0.001$

OBSERVATION AND RESULTS

OBSERVATION AND RESULTS

Table 1:

Group Characteristic in the study people

Character	No of Case (n %)
Ejection Fraction ≤ 30 %	74 (49.3%)
Ejction Fraction 31 % - 40 %	76 (50.7 %)
Male	90 (60 %)
Female	60 (40 %)
NYHA 1	0
NYHA 2	27 (18 %)
NYHA 3	62 (41.3 %)
NYHA 4	61 (40.7 %)
Chest pain	51 (34 %)
Syncope	18 (12 %)
Breathlessness on Exertion	133 (88.7 %)
Paroxysmal Nocturnal Dyspnea	51 (34 %)
Orthopnea	71 (47.3 %)
Decreased Urine Output	16 (10.7 %)
Elevated JVP	71 (47.3 %)
Pedal Edema	35 (23.3 %)
Proportional Pulse Pressure ≤ 25	59
Proportional Pulse Pressure > 25	91
Diabetes mellitus	70 (46.7 %)
Coronary artery disease	114 (76 %)
QRS Widening	86 (57.3 %)
CTR > 55 %	91 (60.7 %)
Pulmonary Edema	86 (57.3 %)

Table2:

Age distribution in study population:

Age in years	No. of patients	N %
25--35	2	1%
35--45	18	12%
45--55	27	18%
55--65	49	33%
65--75	43	29%
75--85	11	7%

In this study more no. of patients clumped in age group of 55 – 75 years, explains it is a disease of aged people, though, significant no. of cases present in younger age group. Mean age is 59years ± 11years.

Table 3:

Sex distribution of the study population

Study population	Male	Female
150	90 (60 %)	60 (40%)

Total number of cases – 150
No. of male – 90
No. of female – 60
Male : Female – 3:2

Fig 1:

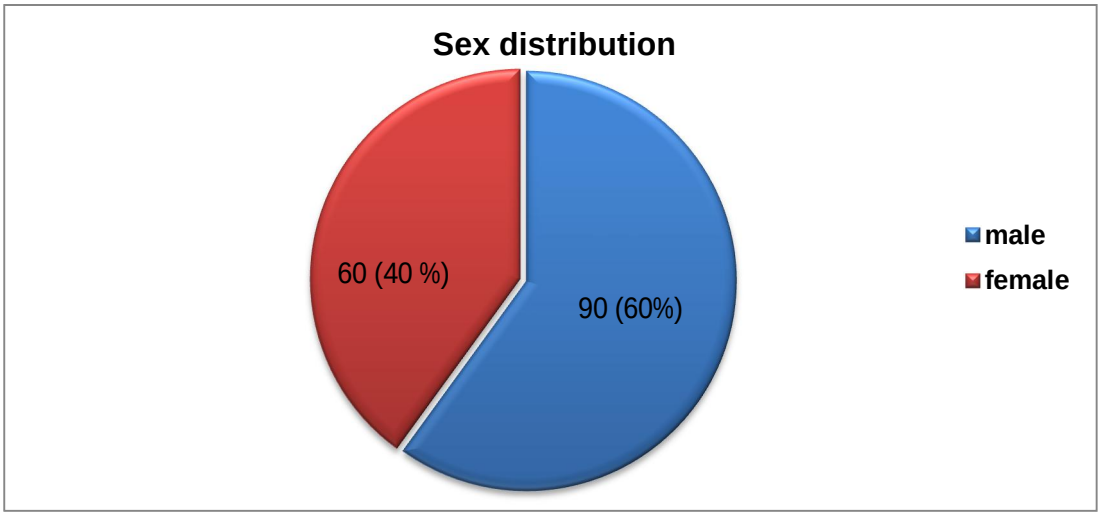


Table 4:

Association of Ejection Fraction with Gender:

Sex	Ejection Fraction (%)		Total
	≥30 %	>30 %	
Male	45 (60.8%)	45 (59.2%)	90 (60%)
Female	29 (39.2 %)	31 (40.8%)	60 (40%)
Total	**74 (100 %)**	**76(100 %)**	**150(100%)**

P value 0.841.

Comments:

There is no significant difference in distribution of ejection fraction among males and females. The pearson chi square value is 0.04 and it is not statistically significant. P value is 0.841.

Table 5:

Distribution of NYHA class in the study people:

Study people	NYHA 1	NYHA 2	NYHA 3	NYHA 4
150	0	27 (18 %)	62 (41.3 %)	61 (40.7 %)

Total no. of cases – 150
No. of cases with NYHA 1 – 0
No. of cases with NYHA 2 - 27
No. of cases with NYHA 3 - 62
No. of cases with NYHA 4 - 61

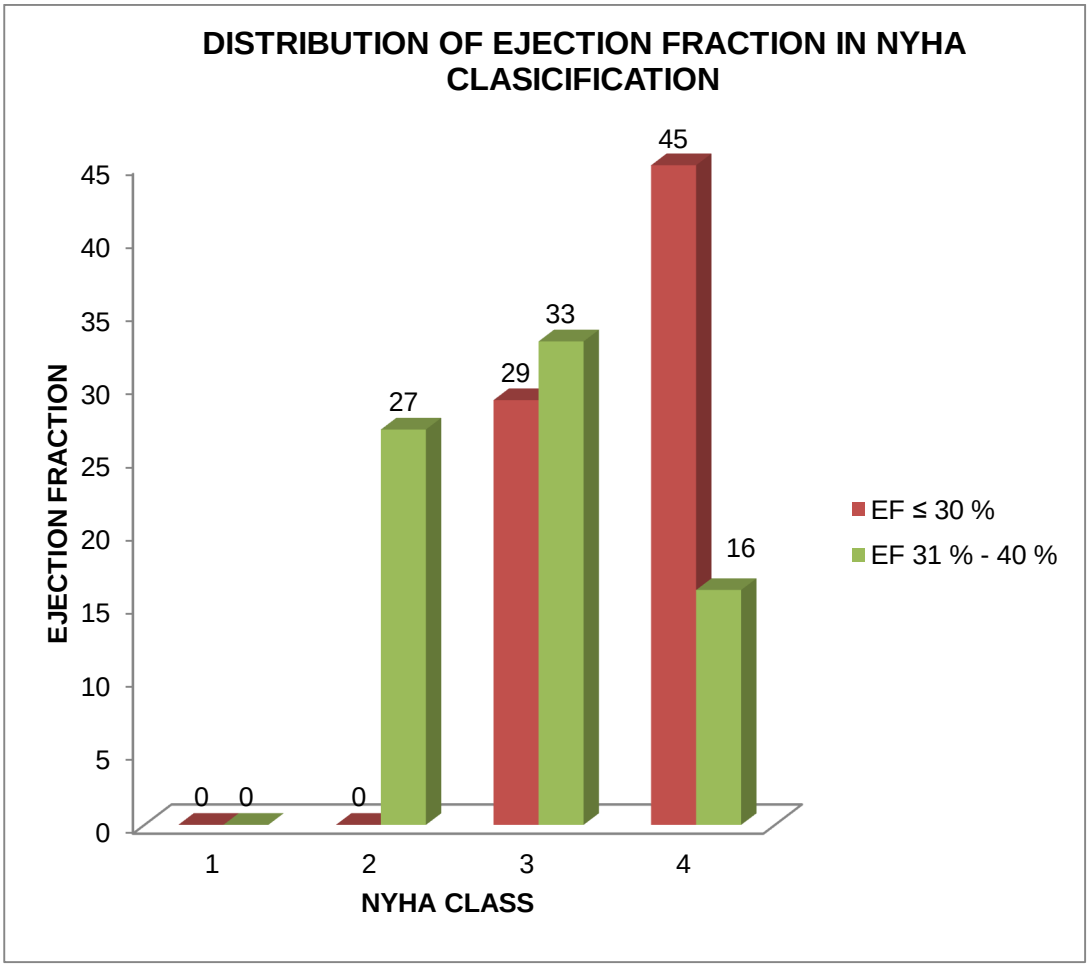
TABLE 6:

Association of NYHA Class with Ejection Fraction:

NYHA CLASS	Ejection Fraction		Total
	≤ 30 %	**31% - 40 %**	
1	0	0	**0**
2	0 (0.00%)	27 (35.50%)	**27 (18.00%)**
3	29 (39.20%)	33 (43.40%)	**62 (41.30%)**
4	45 (60.80%)	16 (21.10%)	61 (40.70%)
Total	74 (100%)	76 (100%)	150 (100%)

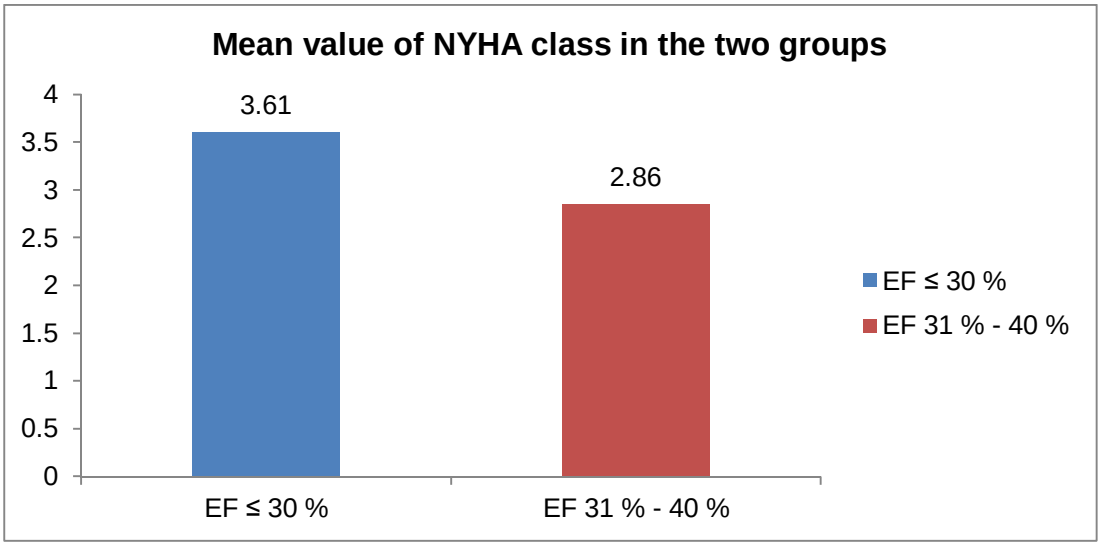
P value <0.001***

Fig 2:



In this study we found that association between nyha class and ejection fraction is highly significant. 60 % of the patients with ejection fraction less than or equal to 30% comes in nyha class 4 and the same time only 20 % of other group had nyha class 4. The pearson chi square value is 41.02 and p value is <0.001 which is highly significant. Increasing NYHA class associated with lower ejection fraction.

Fig 3:



This fig. showed the mean value of NYHA class in cases with ejection fraction less than or equal to 30 % is 3.61 and in cases with ejection fraction >30% is 2.86.

Table 7:

Correlation between NYHA class and ejection fraction:

	NYHA CLASS
N	150
pearson correlation r value	-0.56
p value	<0.001***
Comments	moderate negative correlation

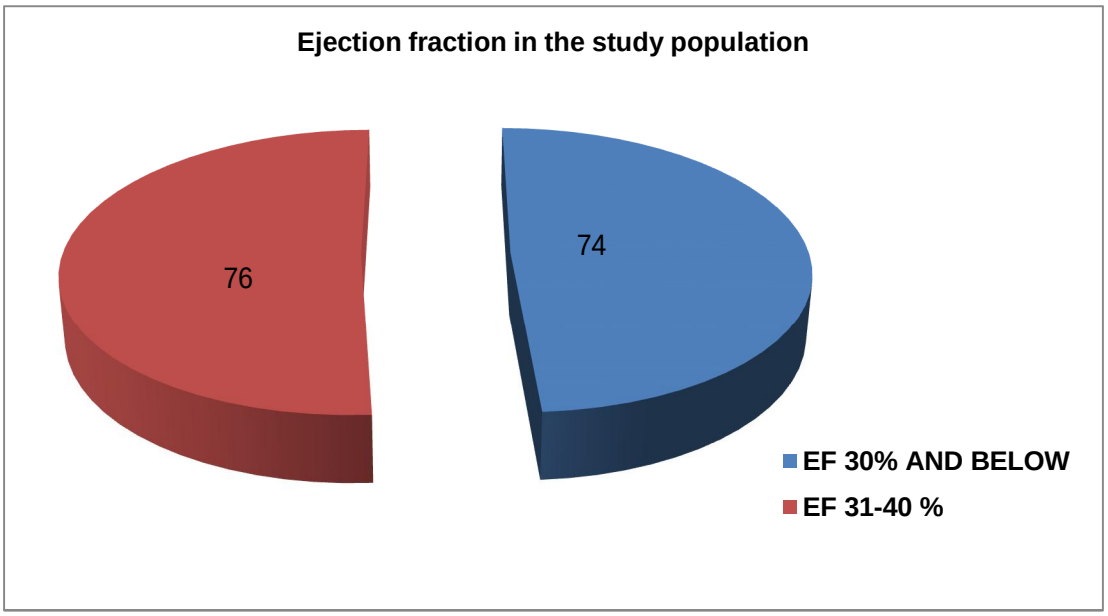
Correlating NYHA class and EF has negative correlation that is one variable increasing means other variable decreasing (i.e NYHA class increases means EF will decrease vice versa).

Table 8:

Ejection fraction in the study population:

Study population	EF 30 % and below	EF 31% to 40%
150 patients (100 %)	74 (49.3 %)	76 (50.7 %)

Fig 4:



Ejection fraction obtained from study people were grouped into two namely, those with ejection fraction < 30 and >30.

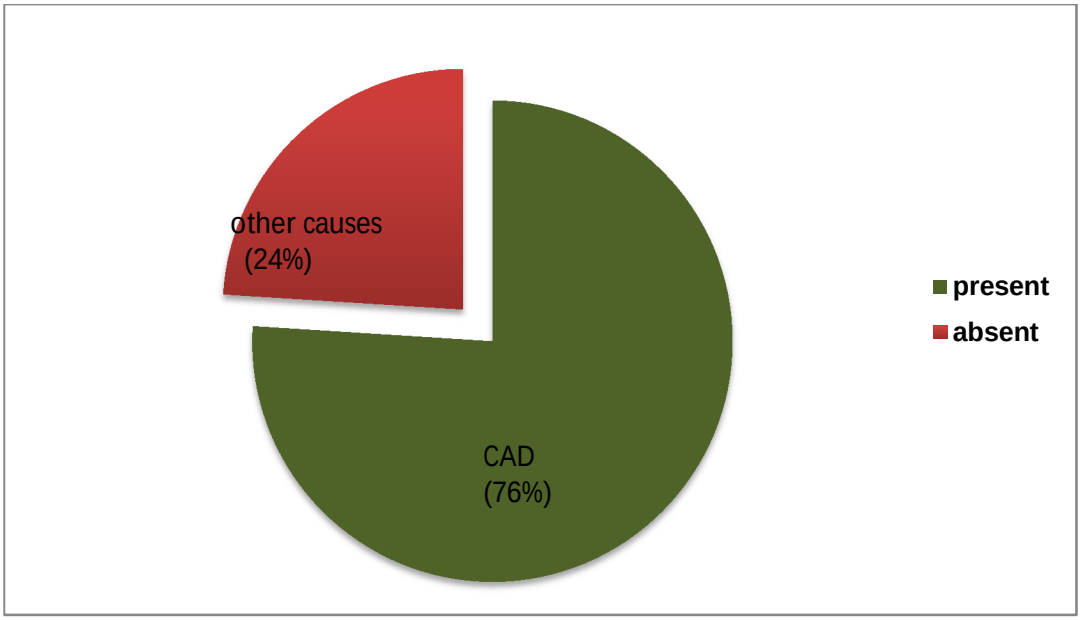
No. of cases with ejection fraction < 30 – 74
No. of cases with ejection fraction > 30 – 76

Table 9:

Distribution of CAD in the study population:

	Coronary artery disease	others
No. of cases	114 (76%)	36 (24%)

Fig 5:



In this study population among 150 case 114 cases (76%) associated with coronary artery disease, it may be aetiology for those cases.

Table10:

Association between breathlessness on exertion and ejection fraction

Breathlessness on exertion	**Ejection Fraction**		**Total**
	≤ 30 %	**>30%**	
Present	74 100%	59 77.60%	**133** **88.70%**
Absent	0 0.00%	17 22.40%	**17** **11.30%**
TOTAL	**74** **100%**	**76** **100%**	**150** **100%**

P value <0.001***

All the patients in the study group with ejection fraction up to 30% had breathlessness on exertion and 59% of the other group also had breathlessness on exertion. The association between ejection fraction and breathlessness on exertion is highly significant. Pearson chi squre value is 18.66. P value is < 0.001.

Fig 6:

Comparison of BOE in two groups:

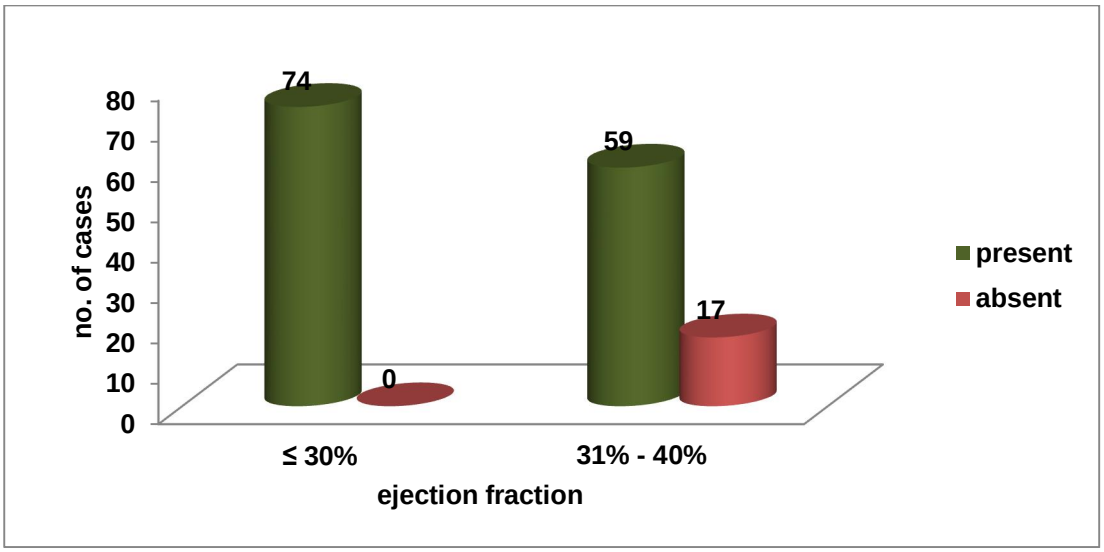


Table11:

Association between orthopnea and ejection fraction:

Orthopnoea	Ejection Fraction		Total
	≤ 30 %	31-40	
Present	47 (63.50%)	24 (31.60%)	71 (47.30%)
Absent	27 (36.50%)	52 (68.40%)	79 (52.70%)
Total	**74 (100%)**	**76 (100%)**	**150 (100%)**

P value <0.001***

In this study, in compare to ejection fraction more than 30 % ,orthopnea more common in ejection fraction less than 30 % patients. There is a statistically significant association present in between orthopnea and ejection fraction. Pearson chi square value is 15.33 and P value is <0.001.

Fig 7:

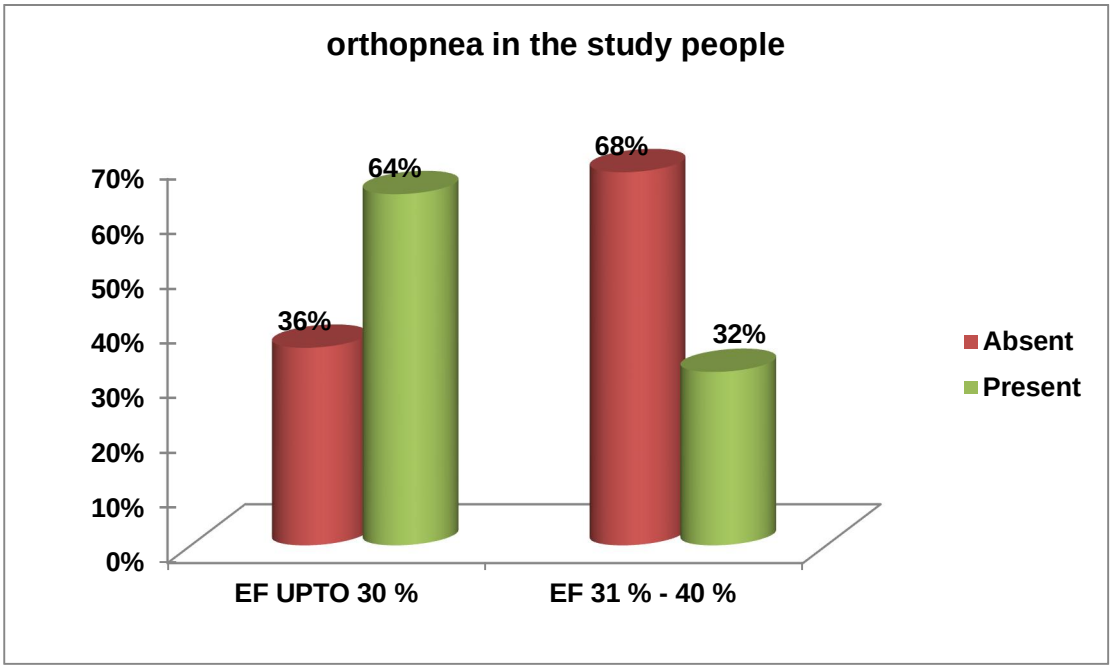


Table12:

Association between decreased urine output and ejection fraction:

Decreased urine output	**Ejection fraction**		**Total**
	≤30%	**31%-40%**	
Present	12 16.20%	4 5.30%	**16** **10.70%**
Absent	62 83.80%	72 94.70%	**134** **89.30%**
Total	**74 (100%)**	**76 (100%)**	**150 (100%)**

P value 0.03*

In the study population 10 % of the patients only complained of decreased urine output. And there is statistically significant difference noted in between the two groups. P value is 0.03.

Table13:

Association between elevated JVP and ejection fraction:

Elevated JVP	**EJECTION FRACTION**		**Total**
	≤30%	**31%-40%**	
Present	54 73.00%	17 22.40%	**71** **47.30%**
Absent	20 27.00%	59 77.60%	**79** **52.70%**
Total	**74** **100%**	**76** **100%**	**150** **100%**

P value <0.001***

Of the 74 cases with ejection fraction less than or equal to30%, 54 patients had elevated JVP. Whereas, of the 76 cases with ejection fraction more than 30 %, only 17 had elevated JVP. Elevated JVP is highly specific clinical parameter for diagnosing patients with heart failure with p value <0.001 which is highly significant.

Fig 8:

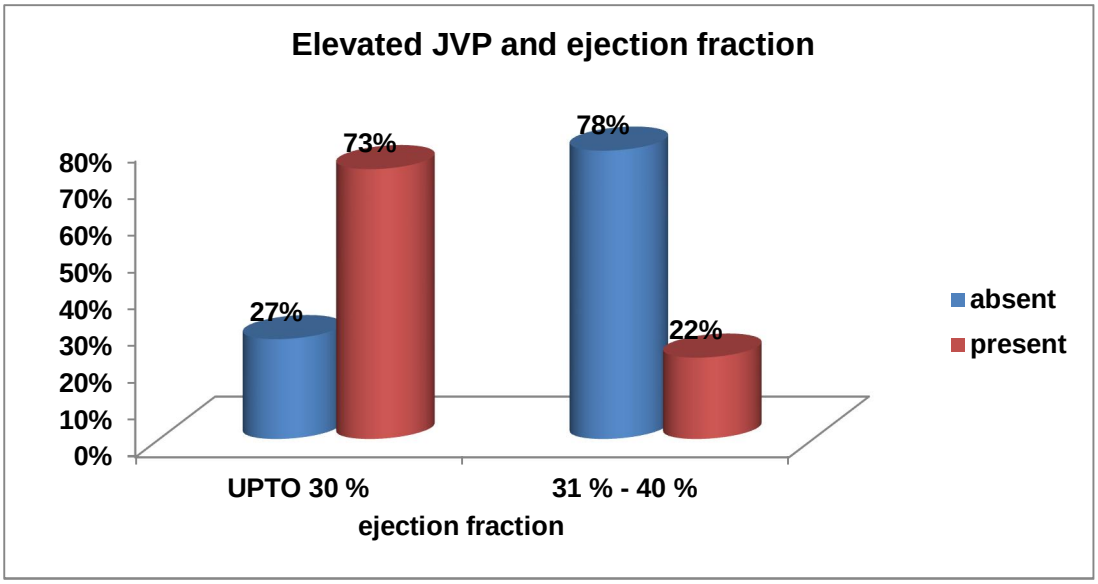


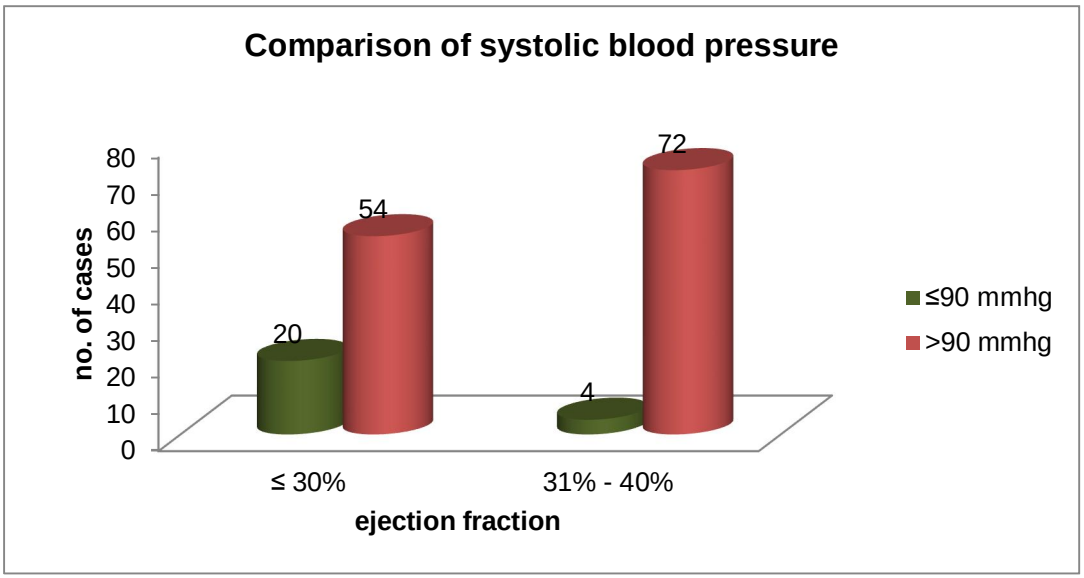
Table 14 :

Association between ejection fraction and systolic blood pressure:

Systolic BP	Ejection fraction		TOTAL
	≤ 30 %	31% - 40 %	
≤90 mmhg	20 (27.02%)	4 (5.26%)	**24 (16%)**
>90 mmhg	54 (72.97%)	72 (94.74%)	**126 (84%)**
TOTAL	**74 (100%)**	**76(100%)**	**150(100%)**

P value 0.001***

Fig 9:



Among 76 cases of group 2 (EF 31 % - 40%), only 4 (5.2%) cases had systolic blood pressure less than 90 mm hg in compare to group 1 (EF ≤ 30%) where 20 (27%) cases had low systolic blood pressure. It showed statistically significant association between ejection fraction and systolic blood pressure. Pearson chi square value is 13.21 and p value is <0.001.

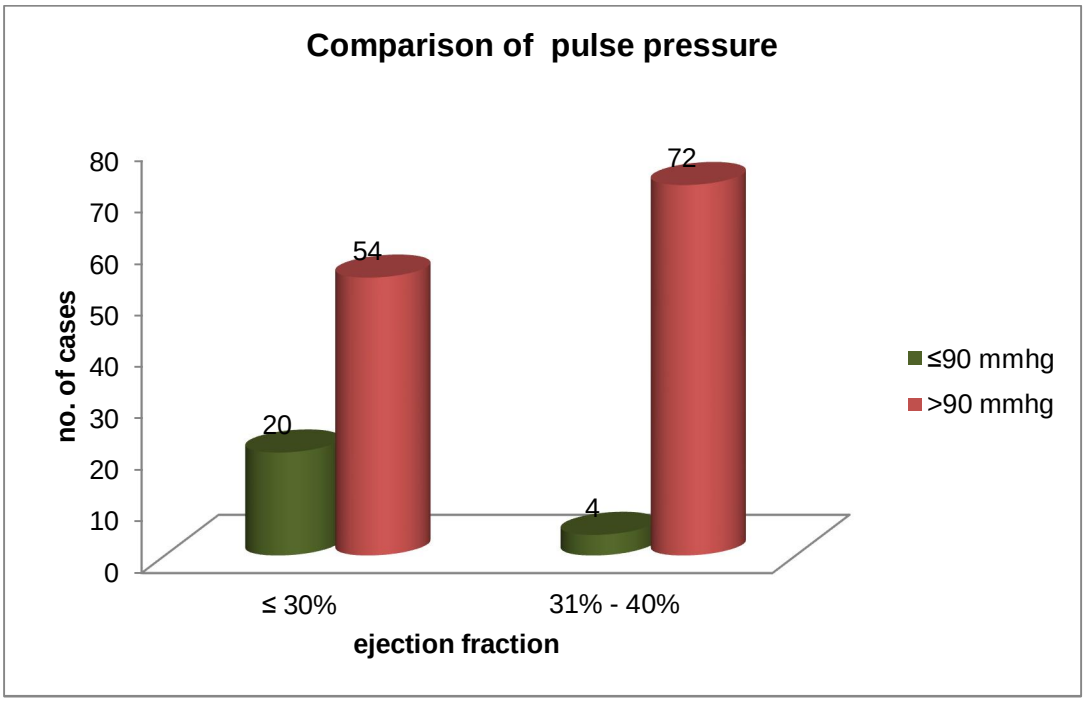
Table 15:

Association between ejection fraction and pulse pressure:

Pulse pressure	Ejection fraction		Total
	≤30%	**31% - 40%**	
≤ 30 mmhg	63 85.14%	12 15.79%	75 50.00%
>30mmhg	11 14.86%	64 84.21%	75 50.00%
Total	**74** **100%**	**76** **100%**	**150** **100%**

P value <0.0001***

Fig 10:



Pulse pressure showed significant association with ejection fraction. Among group 1 (EF ≤30 %), 85 % of cases had low pulse pressure and group 2 (EF >30 %) 85 % of cases had pulse pressure >30 mmhg. Pearson chi square value is 72.11. it is greater than other parameters. P value is <0.0001.

Table 16:

Association between proportional pulse pressure and ejection fraction:

Proportional pulse pressure	**Ejection fraction**		**Total**
	≤ 30 %	**31 % - 40 %**	
Present	43 58.11%	4 5.26%	**47** **31.33%**
Absent	31 41.89%	72 94.74%	**103** **68.67%**
Total	**74** **100%**	**76** **100%**	**150** **100%**

p value <0.0001***

In this study, there is statistically highly significant association present between the ejection fraction and proportional pulse pressure. Chi square value is 48.66 and p value is <0.0001.

Fig11:

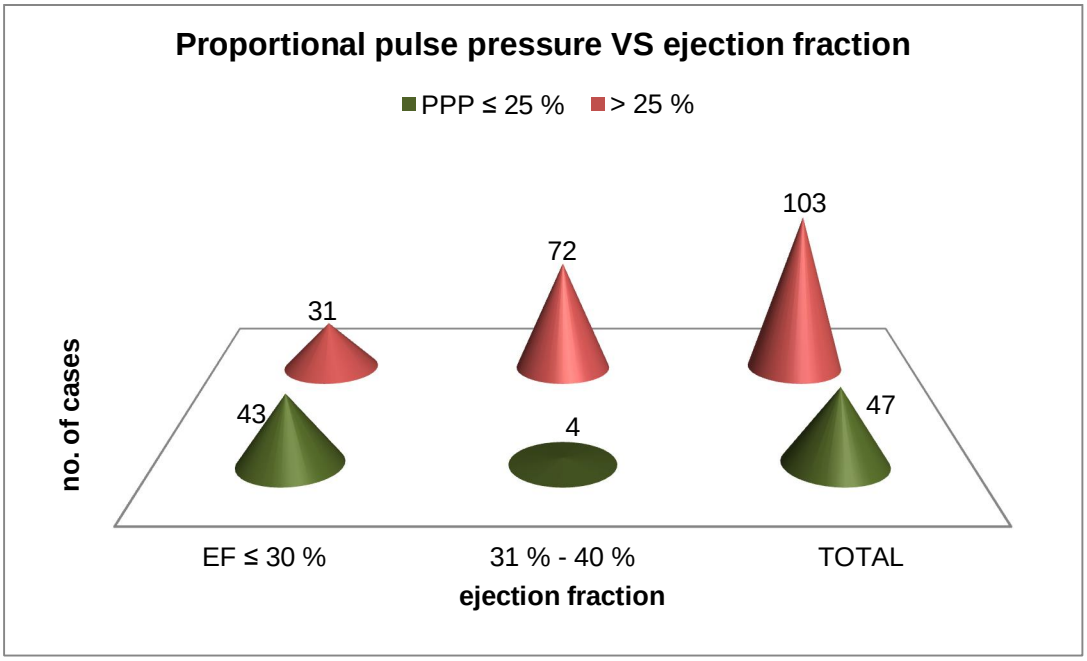


Table 17:

Association between basal crepitation and ejection fraction:

Basal crepitation	Ejection fraction		Total
	≤30%	31% - 40%	
Present	59 79.73%	43 56.58%	102 68%
Absent	15 19.74%	33 43.42%	48 32%
Total	74 100%	76 100%	150 100%

P value 0.002**

In ejection fraction ≤ 30 cases, the basal crepitation present in 59 cases (80%)in compare to ejection fraction > 30% cases where 43 cases (56 %) had basal crepitation. This association is significant with chi square value 9.23 and p value <0.01.

Fig13:

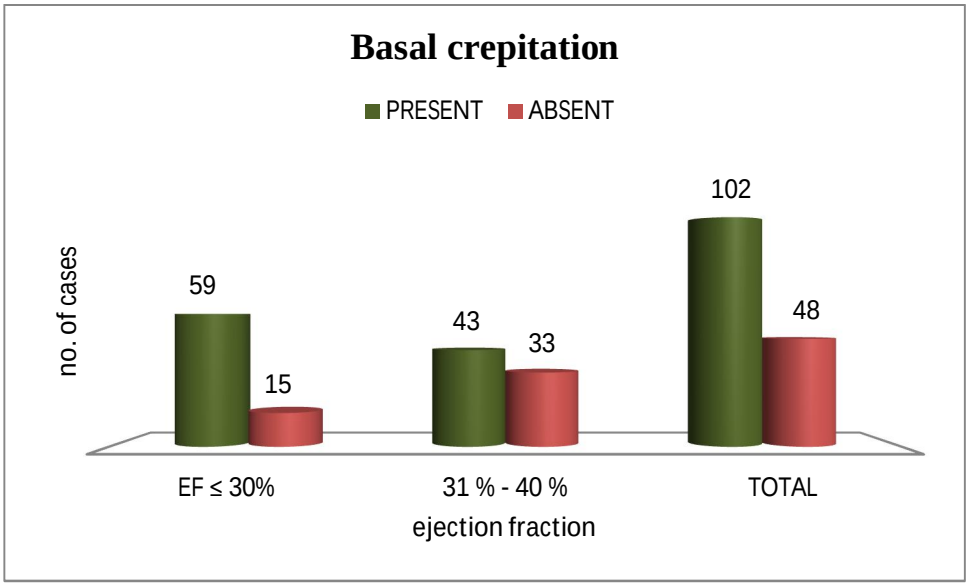


Table 18:

Association between third heart sound and ejection fraction:

Third heart sound	**ejection fraction**		**Total**
	≤ 30 %	**31 % - 40 %**	
Present	23 31.08%	10 13.16%	**33** **22.00%**
Absent	51 68.92%	66 86.84%	**117** **78.00%**
Total	**74** **100%**	**76** **100%**	**150** **100%**

P value 0.008

In this study, totally 33 cases among 150 cases showed presence of third heart sound. The association between ejection fraction and third heart sound is statistically very significant with p value <0.01. chi square value is 7.01.

Table 19:

Association between QRS widening and ejection fraction:

QRS WIDENIG	**Ejection fraction**		**Total**
	≤30 %	**31% - 40%**	
Present	54 73.00%	32 42.10%	**86** **57.30%**
Absent	20 27.00%	44 57.90%	**64** **42.70%**
Total	**74** **(100%)**	**76** **(100%)**	**150** **(100%)**

P value <0.0001***

In this study QRS widening significantly associated with ejection fraction ≤ 30 %. Chi square value is 14.6. the association is highly significant with p value <0.0001.

Fig14:

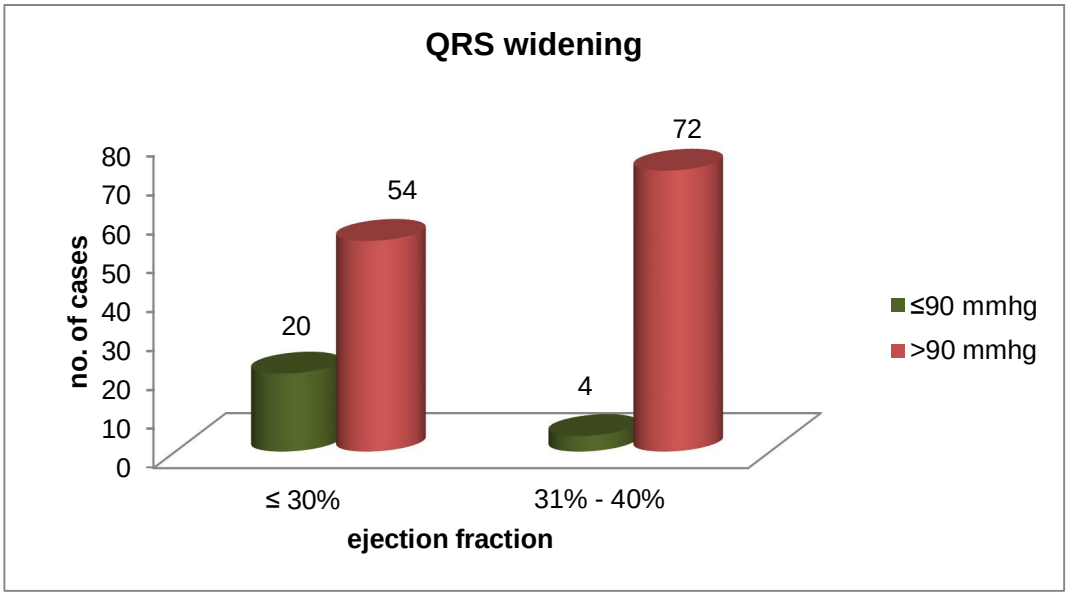


Table 20:

Association between cardiothoracic ratio and ejection fraction:

Cardio thoracic ratio	Ejection fraction		Total
	≤30%	**31%- 40%**	
Present	51 68.90%	40 52.60%	**91** **60.70%**
Absent	23 31.10%	36 47.40%	**59** **39.30%**
Total	**74** **(100%)**	**76** **(100%)**	**150** **(100%)**

P value <0.05*

In this study we found totally 60% of cases with ejection fraction <40% showed cardiothoracic ratio >55%. There is statistically significant association present in between the two. Chi square value 4.168 and p value is <0.05*.

Table 21:

Association between chest pain and ejection fraction:

CHEST PAIN	Ejection Fraction		Total
	≤30 %	**>30 %**	
Present	46 (62.20%)	53 (69.70%)	99 (66.00%)
Absent	28 (37.80%)	23 (30.30%)	51 (34.00%)
Total	**74 (100 %)**	**76 (100 %)**	**150 (100%)**

P value 0.328

In this study the association between chest pain and ejection fraction is not statistically significant. Chi square value is 0.959. p value is o.328. About one third patients complained chest pain in both the groups (in ejection fraction ≤ 30%, 62 % and in ejection fraction > 30%, 69%) . And there is no statistically significant difference in the two groups. P value is >0.05.

Table 22:

Association between syncope and ejection fraction:

Syncope	**Ejection Fraction**		**Total**
	≤30 %	**31% - 40%**	
Present	8 10.80%	10 13.20%	**18** **12.00%**
Absent	66 89.20%	66 86.80%	**132** **88.00%**
Total	**74** **100%**	**76** **100%**	**150** **100%**

P value 0.658

There no significant difference in distribution of syncope in the two groups. The pearson chi square is 0.196 and P value is 0.658.

Table 23:

Association between PND and ejection fraction:

Paroxysmal nocturnal dyspnea	**Ejection Fraction**		**Total**
	≤ 30 %	**31%-40%**	
Present	27 36.50%	24 31.60%	51 34.00%
Absent	47 63.50%	52 68.40%	99 66.00%
Total	74 100%	76 100%	150 100%

P value 0.526

51 patients in the study population complained paroxysmal nocturnal dyspnea. And tabulation showed the association between ejection fraction and PND is not statistically significant (Pearson chi square value is 0.402). P value is 0.526.

Table 24:

Association between pedal edema and ejection fraction:

Pedal edema	**Ejection fraction**		**Total**
	≤ 30 %	**31% - 40%**	
Present	19 25.70%	16 21.10%	**35** **23.30%**
Absent	55 74.30%	60 78.90%	**115** **76.70%**
Total	**74** **100%**	**76** **100%**	**150** **100%**

P value >0.5

Pedal edema not a specific or sensitive parameter for diagnosing patient with heart failure. And there is no statistically significant association gained between the ejection fraction and pedal edema. P value is >0.05.

Table 25:

Utility of clinical data in detecting patients with low ejection fraction (<30%) in heart failure:

Finding	Frequency	Sensitivity	Specificity	PPV	NPV	OR	P
Elevated JVP	71	73%	78%	76%	75%	9.37	<0.001
Pedal edema	35	26%	59%	54%	52%	1.3	>0.5
Systolic BP ≤90	24	27%	95%	83%	57%	6.67	<0.001
Pulse pressure ≤30	75	85%	84%	84%	85%	30.55	<0.001
PPP ≤25	47	58%	95%	91%	70%	24.97	<0.001
Basal crepitation	102	80%	43%	58%	69%	3.02	<0.001
Third heart sound	33	31%	87%	70%	56%	2.9	<0.01

JVP – jugular venous pressure, BP – blood pressure, PPP – proportional pulse pressure,
PPV – positive predictive value, NPV – negative predictive value, OR – odds ratio

In this study clinical data were evaluated for detecting low ejection fraction in heart failure patients. The results were among all the parameter proportional pulse pressure and systolic blood pressure showed high specificity (95%) but both are less common in heart failure in compare to other parameter (sensitivity 58%, 27% respectively, P value - <0.001, OR – 25, 7 respectively). The pulse pressure had good specificity and sensitivity among all the parameter (85%, 84% respectively, p - <0.001, OR – 30.55). In this study showed low sensitivity & specificity for pedal edema(26%, 59% respectively).

Table 26:

Correlation between observed parameter and ejection fraction:

At base line assessment:

	Pulse Rate	**Systolic Blood Pressure**	**Diastolic Blood Pressure**	**Pulse Pressure**	**Proportional Pulse Pressure**
N	150	150	150	150	150
Pearson correlation r value	0.1155	0.6838	0.5415	**0.7439**	0.6667
p value	0.1592	**<0.001*** **	**<0.001*** **	**<0.001*** **	**<0.001*** **
Commands	Weak positive correlation.	moderate positive correlation	moderate positive correlation	moderate positive correlation	moderate positive correlation

In this study we evaluate correlation between ejection fraction and clinical parameters include pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure and proportional pulse pressure by using Pearson correlation coefficient (r value). There is statistically significant moderate positive correlation observed between ejection fraction and pulse pressure, proportional pulse pressure, systolic blood pressure and diastolic blood pressure with p value <0.001*** which is highly significant. Among these parameters the positive correlation is more with pulse pressure (i.e. when pulse pressure decreases ejection fraction also will decrease and vice versa).

Fig 16:

Scatter Charts For Correlation Between EF And PP,SBP,PPP:

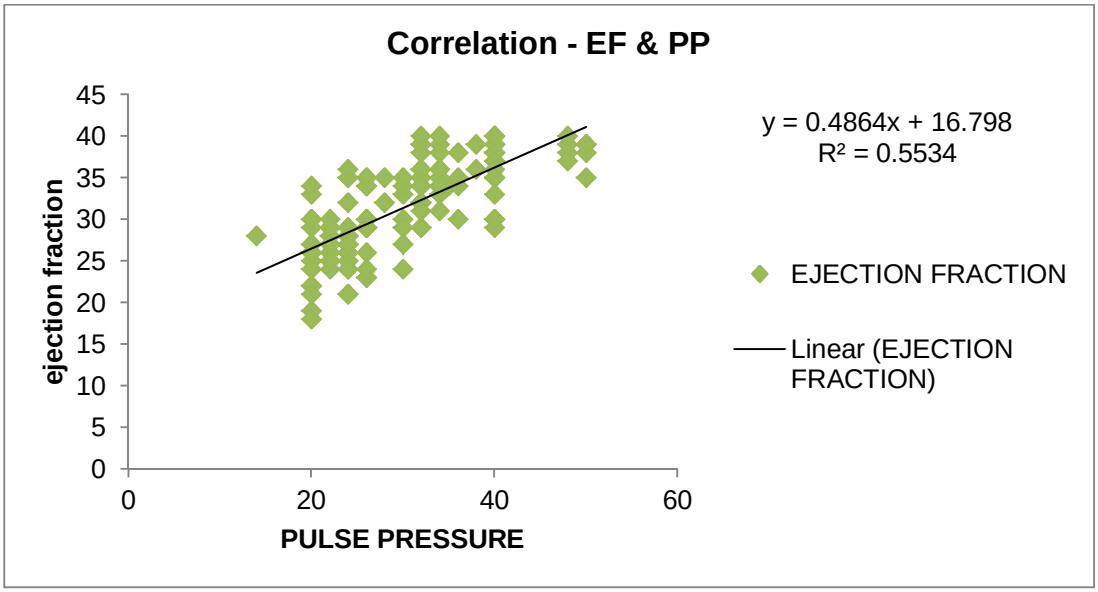


Fig. showed linear positive correlation between ejection fraction and pulse pressure at initial assessment.

Fig 17:

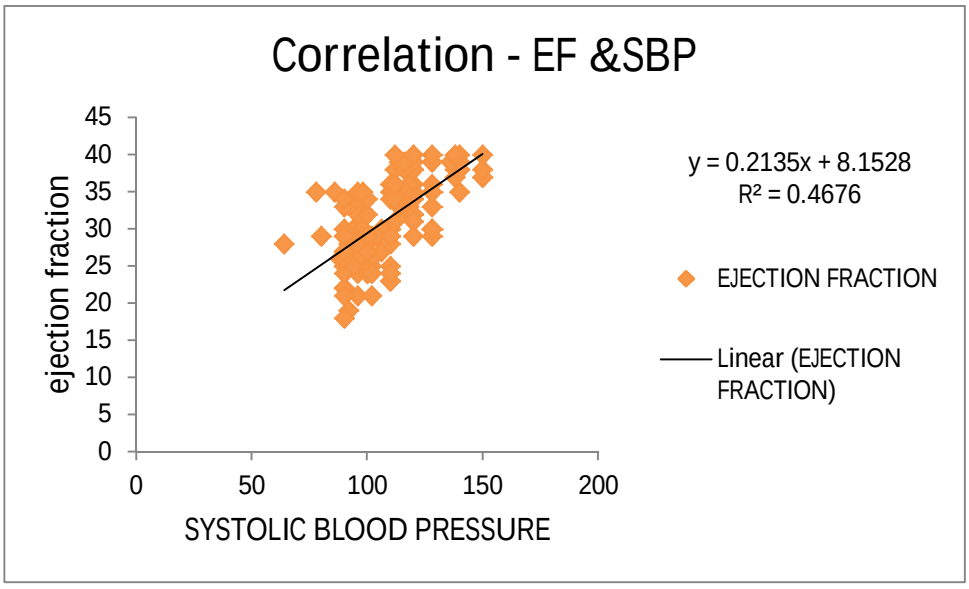


Fig. showed linear positive correlation between ejection fraction and systolic blood pressure at initial assessment.

Fig18:

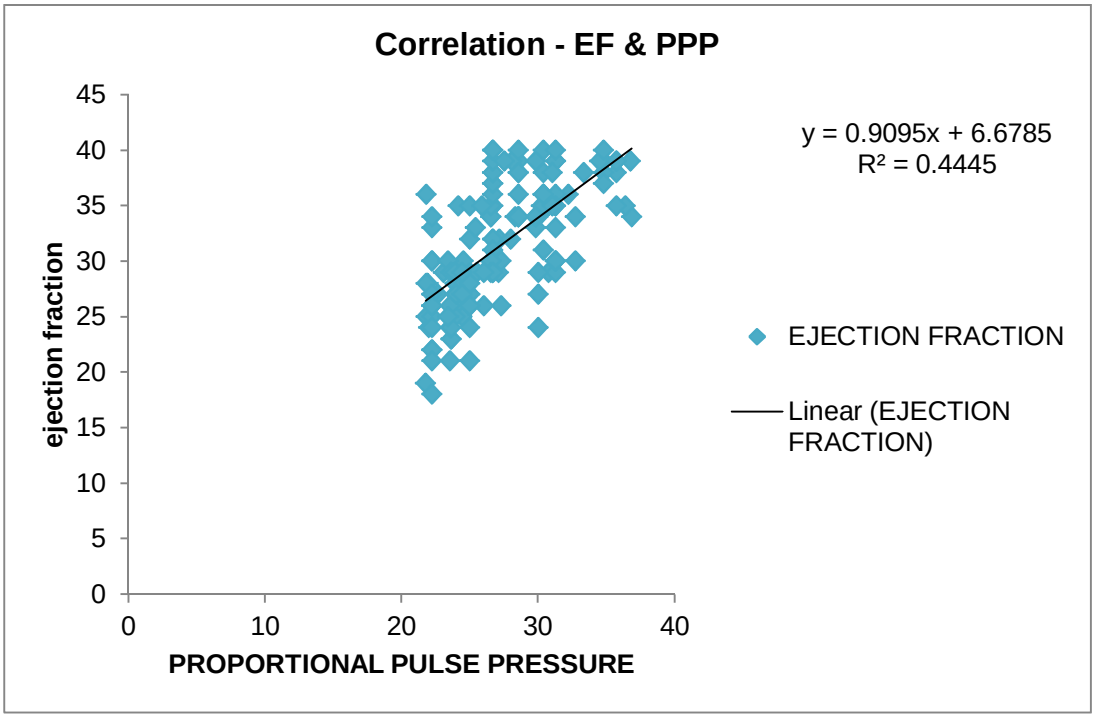


Fig. showed linear positive correlation between ejection fraction and proportional pulse pressure at initial assessment.

Table 27:

During first follow up:

	systolic blood pressure	**diastolic blood pressure**	**pulse pressure**	**proportional pulse pressure**
N	150	150	150	150
pearson correlation r value	0.7264	0.6339	0.7631	0.6676
p value	<0.001***	<0.001***	<0.001***	<0.001***
Commands	moderate positive correlation	moderate positive correlation	strong positive correlation	moderate positive correlation

After 2 months duration at the time of first follow up, the correlations between the significant parameters were reassessed. The results are strong positive correlation for pulse pressure with ejection fraction was noted. The proportional pulse pressure and systolic blood pressure had moderate positive correlation.

Fig18:

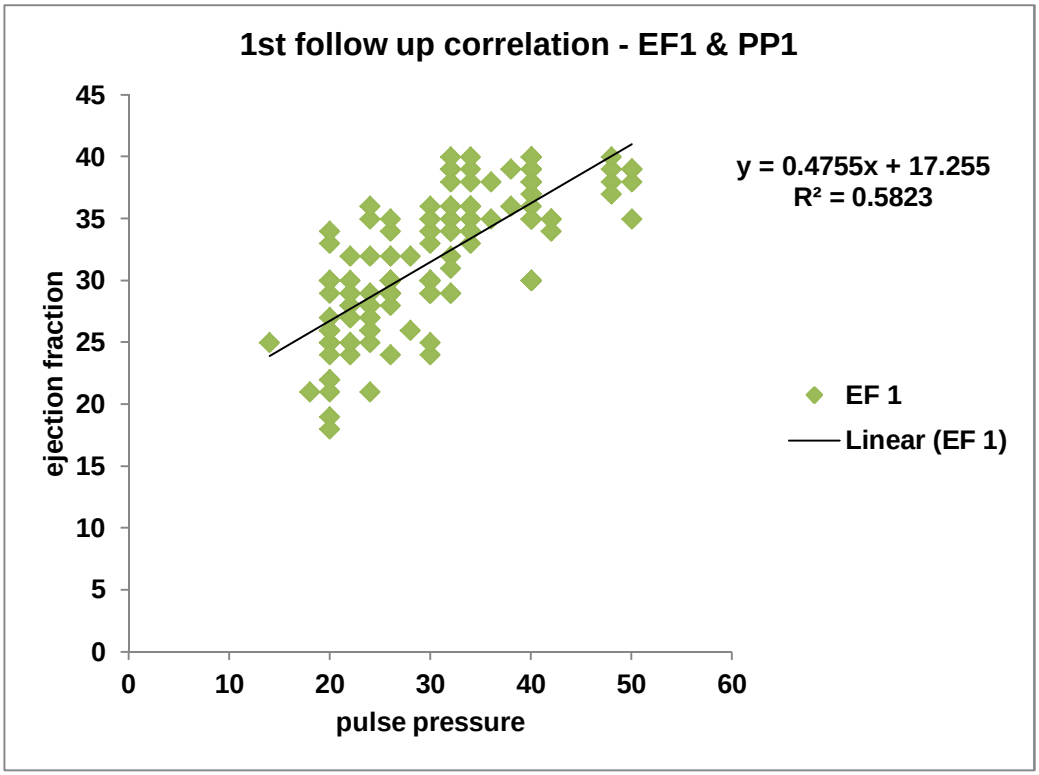


Fig. showed linear positive correlation between ejection fraction and pulse pressure at first follow up.

Fig 19:

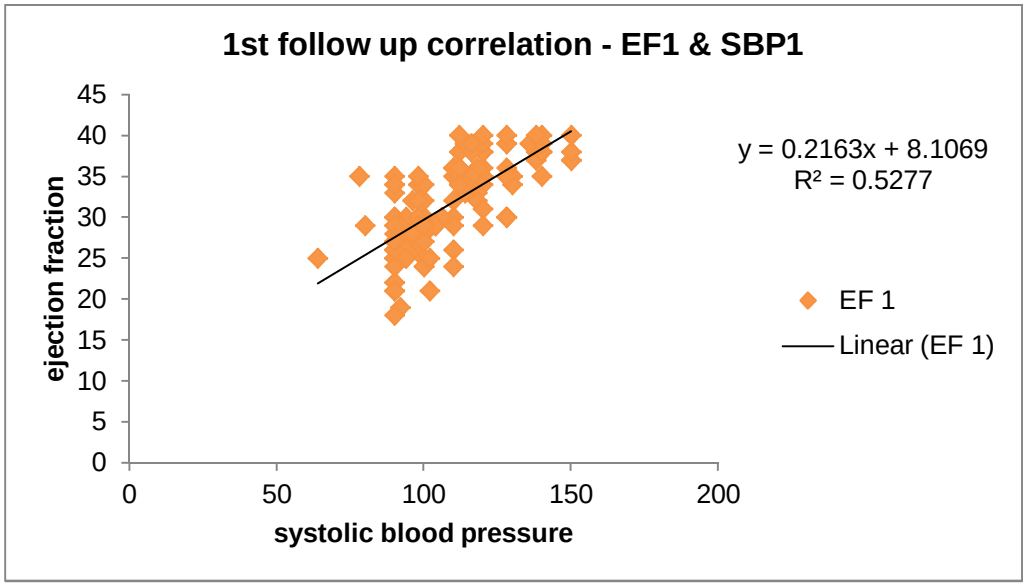


Fig. showed linear positive correlation between ejection fraction and systolic blood pressure at first follow up

Fig 20:

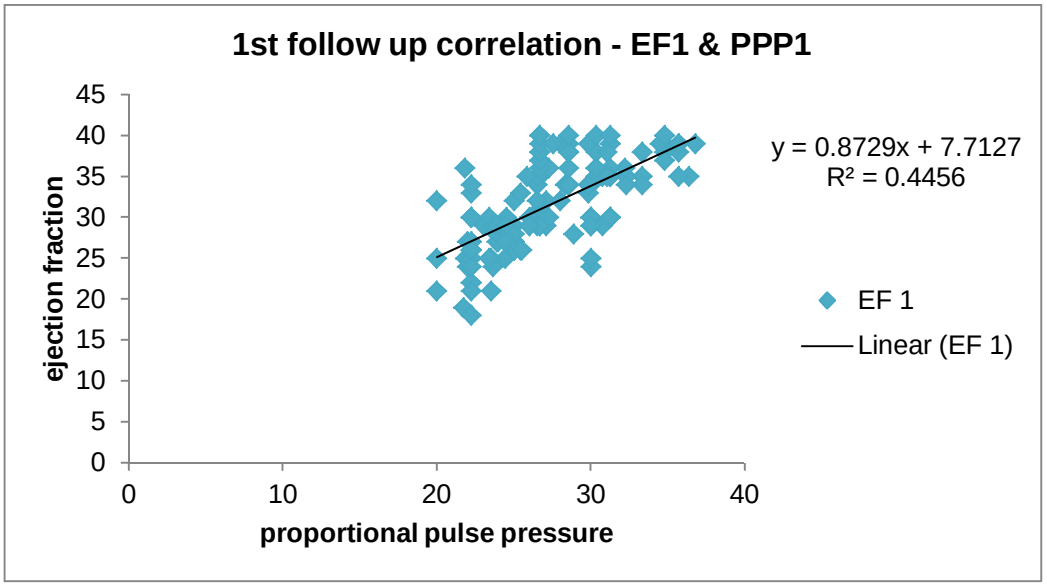


Fig. showed linear positive correlation between ejection fraction and proportional pulse pressure at first follow up.

Table 28:

During second follow up:

	systolic blood pressure	**diastolic blood pressure**	**pulse pressure**	**proportional pulse pressure**
N	150	150	150	150
pearson correlation r value	0.7964	0.6023	0.8213	0.706
p value	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Commands	strong positive correlation	moderate positive correlation	strong positive correlation	moderate positive correlation

After 2 months duration at the time of second follow up, the correlations between the significant parameters were reassessed. The results are strong positive correlation for pulse pressure and systolic blood pressure with ejection fraction noted. The proportional pulse pressure had moderate positive correlation.

Fig 21:

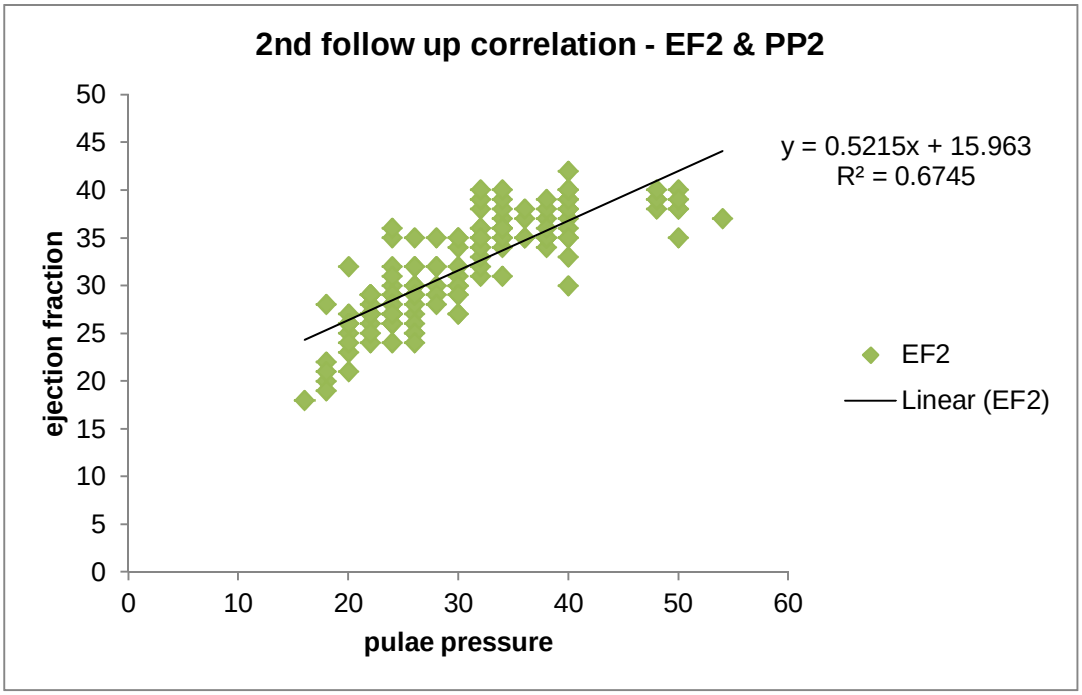


Fig. showed linear positive correlation between ejection fraction and pulse pressure at second follow up.

Fig 22:

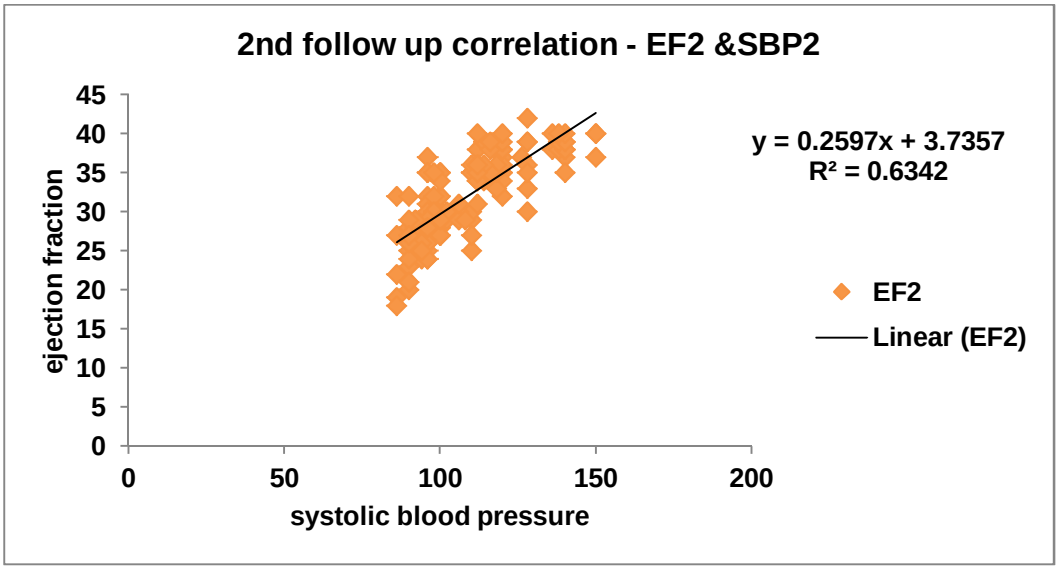


Fig. showed linear positive correlation between ejection fraction and systolic blood pressure at second follow up.

Fig 23:

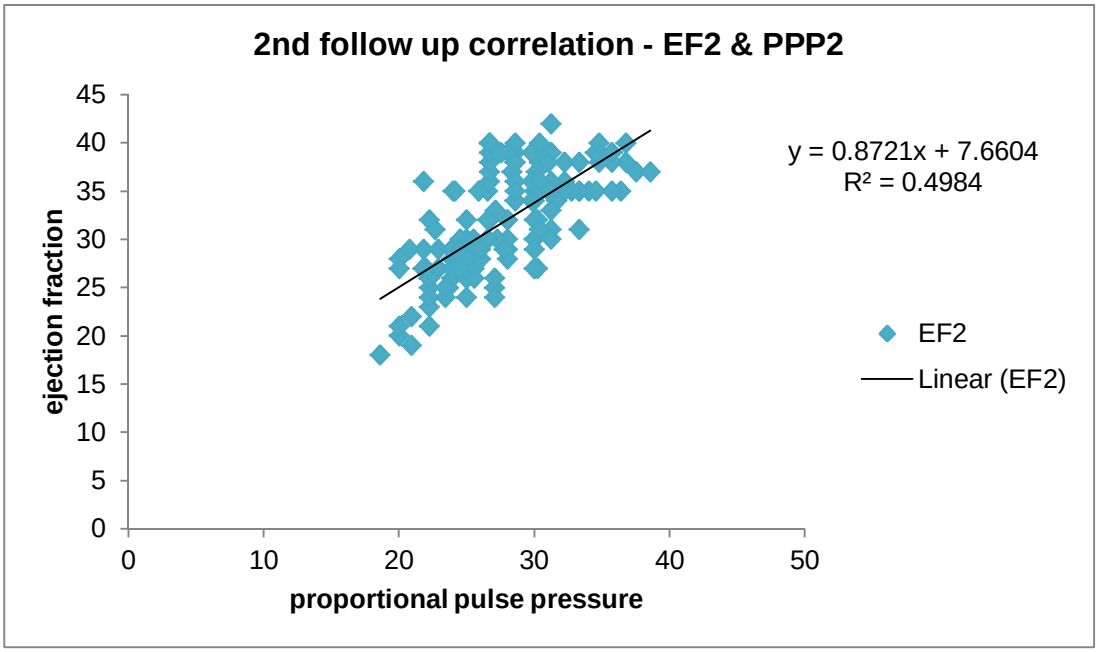


Fig. showed linear positive correlation between ejection fraction and proportional pulse pressure at second follow up.

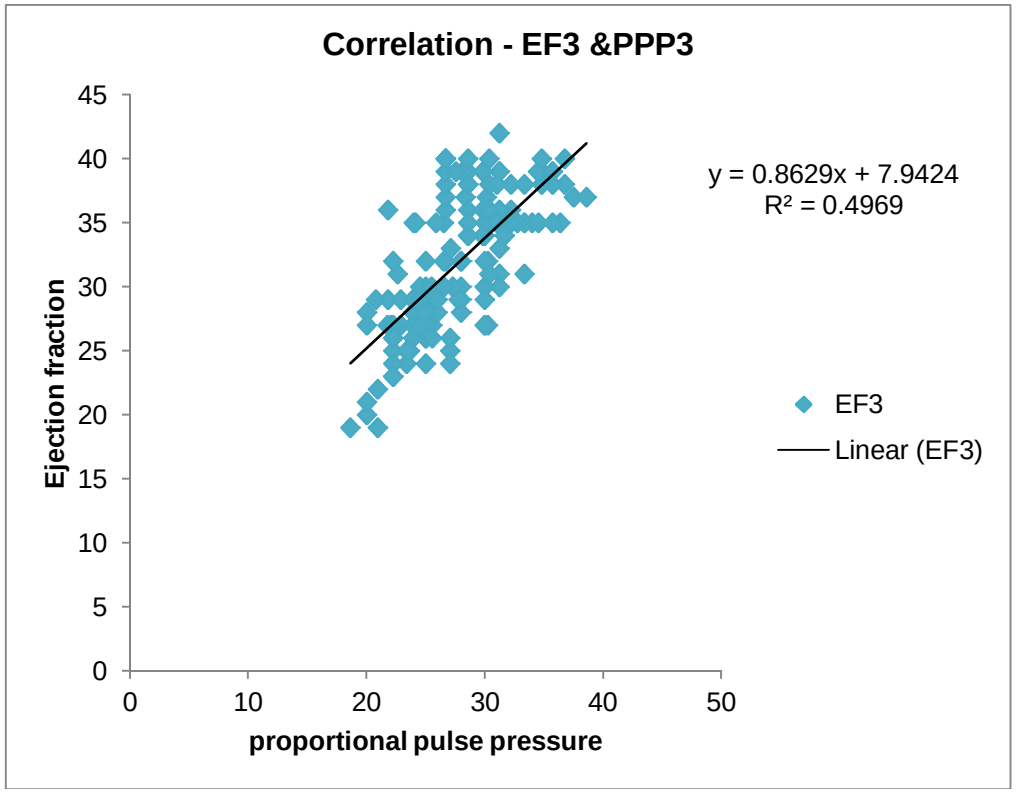
Table 29:

During third follow up:

	systolic blood pressure	**diastolic blood pressure**	**pulse pressure**	**proportional pulse pressure**
N	150	150	150	150
pearson correlation r value	0.7977	0.6353	0.8219	0.7049
p value	<0.001***	<0.001***	<0.001***	<0.001***
Commants	strong positive correlation	moderate positive correlation	strong positive correlation	moderate positive correlation

After 2 months duration at the third follow up, the correlations between the significant parameters were reassessed. The results are same as second follow up (strong positive correlation for pulse pressure and systolic blood pressure with ejection fraction) was noted. And the proportional pulse pressure had moderate positive correlation.

Fig 24:



THE ANOVA TABLE TEST:

The acceptability of the model from a statistical perspective.

Table 30:

ANOVA(b)						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	1898.332	1	1898.332	118.414	.0001a
	Residual	2372.628	148	16.031		
	Total	4270.96	149			

a.Predictors: (Constant), PPP

b. Dependent Variable: EJECTION FRACTION

The Regression row displays information about the variation accounted for by your model.

The Residual row displays information about the variation that is not accounted for by your model.

The significance value of the F statistic is less than 0.05, which means that the variation explained by the model is not due to chance

While the ANOVA table is a useful test of the model's ability to explain any variation in the dependent variable, it does not directly address the strength of that relationship.

MODEL SUMMARY

Table 31:

Model Summary(b)				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.667a	0.444	0.441	4.004

a. Predictors: (Constant), PPP

b. Dependent Variable: EJECTION FRACTION

The model summary table reports the strength of the relationship between the model and the dependent variable. Its large value indicates a strong relationship.

R Square, the coefficient of determination, is the squared value of the multiple correlation coefficient. It shows that about half the variation in Ejection fraction is explained by this study model.

COEFFICIENT OF REGRESSION:

Table 32:

Coefficients(a)								
Model		**Unstandardized Coefficients**	**Standardized Coefficients**			**95% Confidence Interval for B**		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	6.679	2.299	…	2.905	0.004	2.136	11.221
	PPP	0.91	0.084	0.667	10.882	0.0001	0.744	1.075
a. Dependent Variable: EJECTION FRACTION								

This table shows the coefficients of the regression line.

It states that the expected Ejection fraction is equal to 6.679+ 0.91* Proportional pulse pressure (the linear regression equation is Y = a+ bX). If proportional pulse pressure is 25%, the predicted Ejection fraction would be equal to 6.679 + 0.91*25 calculated as 29.429 that is ejection fraction nearly 30%, that is predicted from proportional pulse pressure. It implies that in severe left ventricular dysfunction (EF<30 %) the possibility of proportional pulse pressure being <25% is high.

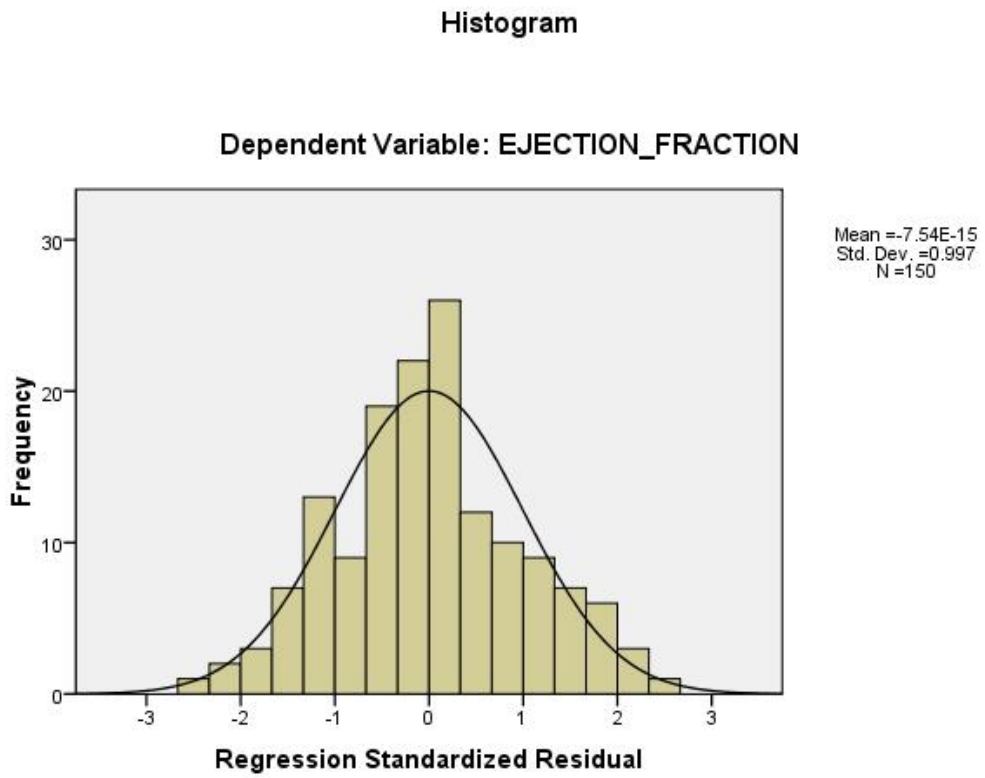
COEFFICIENT OF REGRESSION LINE DURING FOLLOW UP

Table 33:

Coefficients(a)								
Model		**Unstandardized Coefficients**	**Standardized Coefficients**			**95% Confidence Interval for B**		
		B	**Std. Error**	**Beta**	**t**	**Sig.**	**Lower Bound**	**Upper Bound**
1	(Constant)	6.679	2.299		2.905	0.004	2.136	11.221
	PPP	0.91	0.084	0.667	10.882	0.0001	0.744	1.075
2	(Constant)	7.713	2.216		3.48	0.001	3.334	12.092
	PPP_FUP1	0.873	0.08	0.668	10.907	0.0001	0.715	1.031
3	(Constant)	7.66	2.023		3.788	0.001	3.664	11.657
	PPP_FUP2	0.872	0.072	0.706	12.126	0.0001	0.736	1.014
4	(Constant)	8.596	2.164		3.972	0.001	4.318	12.874
	PPP_FUP3	0.846	0.076	0.682	11.072	0.0001	0.695	0.997
a. Dependent Variable: EJECTION FRACTION								

During follow up every 2 months, the reassessed coefficient regression line showed improvement in proportional pulse pressure associated with improvement in ejection fraction also by decreasing b value (0.744 - 1.075,0.715 - 1.031, 0.736 - 1.014, 0.695 - 0.997) in each follow up.

Fig 25:

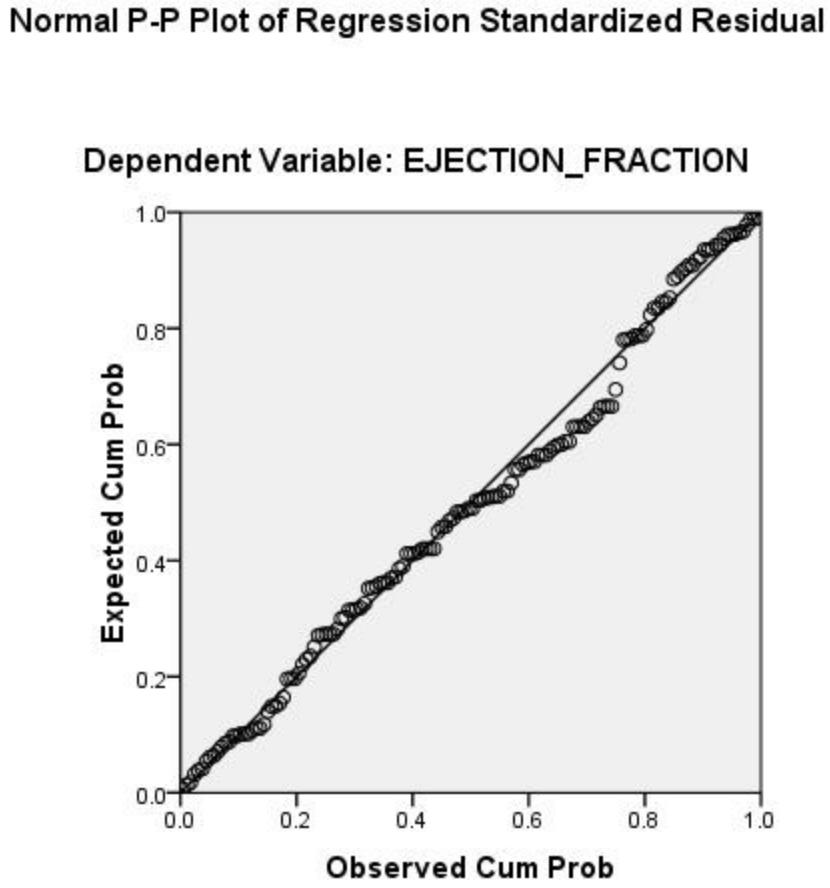


A histogram or P-P plot of the residuals helps to check the assumption of normality of the error term.

The shape of the histogram should approximately follow the shape of the normal curve. This histogram is acceptably close to the normal curve.

(A residual is the difference between the observed and model-predicted values of the dependent variable.)

Fig 26:



The P-P plotted residuals should follow the 45-degree line. Neither the histogram nor the P-P plot indicates that the normality assumption is violated.

DISCUSSION

DISSCUSSION

Heart failure remains a common diagnosis for patients presenting with breathlessness on exertion. Because of high mortality, poor quality of life heart failure patients requires repeated admissions[1-2].

Heart failure is often diagnosed by detailed clinical history, careful clinical examination and characteristic findings of electro cardiogram and chest X-RAY[1-2].

The clinical history alone is insufficient to diagnose heart failure, only it will give information related to etiology, precipitating factor and severity of illness.

The symptoms and signs of heart failure can be related to either decreased cardiac output or fluid retention. In clinical history, absence of breathlessness on exertion promisingly rules out left ventricular dysfunction related heart failure.

In examination elevated jugular venous pressure can be a reliable indicator for increased central venous pressure. Pulmonary crepitation mostly present in acute and sub-acute heart failure, as times goes on compensatory mechanism for low cardiac output and water retention clears crepitation in chronic heart failure[1-2].

Pedal edema present merely in less than 25% of patient with the age of less than 60 years. Hence it is not reliable indicator for heart failure.

Though lots of clinical studies done over clinical parameter in heart failure, none of the study says any individual parameter is reliable one for diagnosing heart failure. Most of the clinical parameter has its own merits and demerits. Hence multiple clinical parameters have to be applied for diagnosing heart failure.

In this scenario we rely on sophisticated investigations like echo cardiogram and level of brain natriuretic peptide to evaluate the heart failure.

Hence we evaluated the clinical utility of clinical data (elevated JVP, pedal edema, systolic blood pressure, pulse pressure, proportional pulse pressure, basal crepitation, and third heart sound) which are non-invasive and easily applicable even at primary health care sitting for identifying patients with heart failure. We hope, this information will help physician in decision making and prognosis assessment in heart failure patients even at ambulatory level.

This study population comprised of 150 patients with heart failure with reduced ejection fraction who satisfied the inclusion and exclusion criteria. During initial assessment patients were admitted as inpatient and a detailed clinical history and examination were done followed by laboratory assessment, electrocardiography and chest X-RAY were done and echocardiogram was done.Treatment was initiated or continued as per the standard hospital protocol. The study population was grouped into two (1) Ejection fraction ≤ 30%, Ejection fraction, (2) 31% - 40%, to study the association between clinical parameter and ejection fraction.

Distribution of age group among the study population was calculated. The results were 49 (33 %) in the age group between 55 – 65 years and 43 (29 %) in the age group between 65 -75 years. In this study heart failure was more commonly present in patients older than 55 years, may be because of better survival after acute coronary syndrome and improved management protocol [29]. Louis et al[35], studied about heart failure assessment tool over 372 patients, where the mean age was 53 years ± 13 years. This is in accordance with our study were the mean age is 59 years ± 11 years.

In this study, the male female ratio was approximately 3:2 (Fig:1). Although there is no sex related difference in the distribution of heart failure described in literature. The relative incidence is low in women than in man. Our study also did not show any association between ejection fraction and gender at p value 0.84 (Table:4).

In this study among 150 patients, nearly 80% of patients presented with NYHA class 3 and 4 (table 5). The association of NYHA class with ejection fraction showed statistically significant association at p value < 0.001 (Table: 6). The mean value of NYHA class in patients with ejection fraction less than 30% was 3.61, where as in patients with ejection fraction more than 30 % was 2.86(Fig: 3). When NHYA class increases ejection fraction decreases. Tansel et al[36], studied about pulse pressure as a predictor of cardio vascular death, where they showed a significant association of worsening NHYA class with decreased ejection fraction, similar to our study. The correlation between NHYA class and ejection fraction was studied with pearson correlation coefficient. It showed moderate negative correlation (Table: 7). The r value is -0.56 and p value < 0.001. It explained if NHYA class increases ejection fraction will decrease and vice versa.

In this study among 150 study population 114 patients had associated with coronary artery disease (Table: 9). Harrison[1] says in developed countries coronary artery disease has become the predominant cause and is responsible for 60-75 % of cases of heart failure. Similar finding noted in this study also.

Lots of studies explained breathlessness on exertion as the most common complaint given by patients with heart failure[34-56]. Similarly, in our study also showed the strong association of breathlessness on exertion with ejection fraction at p value <0.001(Table: 10). All the cases with ≤ 30 % ejection fraction had breathlessness on exertion. Orthopnea (taken in account when patient used ≥ two pillows) was significantly associated with ejection fraction ≤ 30 % (p value < 0.001). Other orthopnea related studies also give similar findings.[41,42]. Mark H et al, [34,44] studied clinical assessment in heart failure over 194 patients, they observerd 157 patients among 192 (80%) complained of orthopnea . In our study 64% of patients with low ejection fraction had orthopnea. Hence the association between orthopnea and low ejection fraction was highly significant (table: 11).

Though, decreased urine out put was infrequent in heart failure it showed significant association with low ejection fraction with p value <0.05 (table:12).

A large, analytical study by Mark h dranzeret. al.,[34] showed elevated jugular venous pressure and third heart sound as prognostic indicator in asymptomatic patients with heart failure. Elevated jugular venous pressure was associated with poor outcome in heart failure patients []. In our study also elevated JVP showed highly significant association with low ejection fraction, p value is <0.001 (table: 13).

In two studies conducted in heart failure patients to study the outcome related to systolic blood pressure, the results showed patients with low systolic blood pressure had poor out comedespite medical therapy [32,67]. In this study, the association between low systolic blood pressure (< 90 mmhg) and low ejection fraction was calculated by chi square test and the test showed a significant p value <0.001 (table 14).

In our study the mean value of pulse pressure was around 30mmhg and it was taken as cut off value. 85percent of the patients with low pulse pressure (≤30 mmhg) showed low ejection fraction, same way patients with >30mmhg pulse pressure had ejection fraction > 30% (fig 11).

The association between pulse pressure and ejection fraction was highly significant with chi square value of 72 and p value is < 0.001 (table 15). Many studies were conducted about pulse pressure in heart failure for example, " pulse pressure as predictor of cardio vascular death" [35,57], "pulse pressure and QRS widening as an inexpensive tool to diagnose heart failure" [38,42], "history and physical examination - Importance in hear failure" [36,46], all the studies explained the importance and association of pulse pressure in heart failure.

Pulse pressure is a good indicator for heart failure which helps in risk assessment and prognosis in heart failure. Low pulse pressure is always associated with poor prognosis in heart failure[30,48,57,68] which is in accordance with our study results.

The proportional pulse pressure in the study group was assessed by Pearson chi square test. Proportional pulse pressure ≤ 25 % was significantly associated with an ejection fraction ≤ 30 %. Among our study population, 47 cases (31%) showed proportional pulse pressure ≤ 25 % among those 43 (90%) patients had low ejection fraction of ≤ 30 %. This association is statistically significant with p value < 0.001and chi square value of 48.66 (table 16).

A study conducted in Hungary by miklosdekany[37] about “A non invasive tool - proportional pulse pressure as prognostic indicator in advanced systolic left ventricular dysfunction patients and its therapeutic implication” showed, patients with proportional pulse pressure ≥ 40 mmhg had favorable long term prognosis.

A proportional pulse pressure is a noninvasive and inexpensive risk indicator which can be used in daily clinical practice for risk assessment in heart failure patients and during follow up for optimization of treatment[34,64,53]. According to Braunwald’s heart disease a text book of crdiology[38,72,69], proportional pulse pressure ≤ 25 % was significantly associated with a low cardiac index of less than 2.2 lit / min/ m^2. These results were also noted in our study i.e. Propotional pulse pressure ≤25 % was significantly associated with low ejection fraction (<30%).

Pulmonary added sounds (crepitation) involving more than 1/3 of lung base was significantly associated with low ejection fraction. In group I (Ejection fraction ≤ 30 %) among 74 patients, 59 patients (80%) showed basal crepitation.

As we discussed previously, the study related to “Third heart sound and elevated jugular veneous pressure as a prognostic indicator in asymptomatic heart failure”[34,29,59]. Presence of third heart sound in heart failure was associated with poor prognosis.

In our study also,totally 33 cases among 150 cases showed presence of third heart sound, in that 23 patients had low ejection fraction. The association between ejection fraction and third heart sound is statistically very significant with p value <0.01. Pearson chi square value was 7.01.

QRS widening (>120ms) is better tool for assessing patient with heart failure, combined with pulse pressure its clinical utility was increased[47,56,70]. In our study among 74 patients in group I (EF ≤ 30 %) 54 cases (73 %) showed wide QRS complex. The association between QRS widening and low ejection fraction was statistically highly significant at p value < 0.001. Chi square value is 14.6 (table 19).

The increased cardio thoracic ratio (> 55 %) was one of the criteria for diagnosing heart failure [32,40,66]. In our study among 91 patients with increased cardio thoracic ratio nearly 55 % had ejection fraction ≤ 30 % and other 45 % had ejection fraction > 30. Though it

seems to be no much difference in between the two groups, the association between ejection fraction and increased cardio thoracic ratio was statistically significant at p value <0.05. Chi square value 4.168 (table: 20).

In our study the association between chest pain and ejection fraction was not statistically significant. Chi square value was 0.95 and p value was 0.328. About two third patients complained chest pain in both the groups (62% in ejection fraction ≤ 30% and 69% in ejection fraction >30%). And there was no significant difference in the two groups.

In this study population syncope was an infrequent finding and there was no significant difference in distribution of syncope between the two groups. The pearson chi square was 0.196 and P value was 0.658 (table 22).

In our study, 51 patients in the study population complained paroxysmal nocturnal dyspnea. The association between ejection fraction and paroxysmal nocturnal dyspnea was not statistically significant (table 23). Pearson chi square value was 0.402 and P value was 0.526.

Pedal edema was not a specific or sensitive parameter for diagnosing patient with heart failure. And there was no statistically significant association gained between the ejection fraction and pedal edema. P value was >0.05 (table24).

Utility of clinical data in detecting patients with low ejection fraction (<30%) in heart failure was calculated using sensitivity, specificity, positive and negative predictive value. The results of my study showed that among all the parameters, proportional pulse pressure and systolic blood pressure showed high specificity (95%) but both are less common in heart failure as compared to other parameters, hence low sensitivity 58%, 27% respectively (P value - <0.001, odds ratio (OR) – 25, 7 respectively). The pulse pressure had good specificity and sensitivity among all the parameter (85%, 84% respectively, p - <0.001, OR – 30.55). This study showed low sensitivity & specificity for pedal edema(26%, 59% respectively). Basal crepitation had low specificity (43%) and good sensitivity (80%). Third heart sound had low sensitivity (32%) and good specificity (87%).

Some of the clinical parameters were compared with the study done by mark h dazner[34] – the ESCAPE trial “The value of hemodynamics in clinical assessment in advanced heart failure”.

Elevated jugular veneous pressure (> 8mmhg) showed 65 % sensitivity and 64% specificity where as in our study, it was 73% and78% respectively. The sensitivity and specificity of pedal edema (≥2+) was 66 % and 41 % respectively but in our study it was 59 %, 26% respectively. The results are in accordance with our study.

In their study pulmonary crepitation showed low sensitivity (15%) and good specificity. Whereas, in our study the sensitivity and specificity were 80% and 43% respectively i.e. pulmonary crepitation had high sensitivity and low specificity comparatively. Third heart sound showed 62% sensitivity, 32 % specificity, in our study it was 31 % and 87% respectively.

Though, low systolic blood pressure (< 90 mmhg) and proportional pulse pressure ≤ 25 mmhg was an infrequent parameter (sensitivity < 50 %) observed in heart failure patients both parameter showed good specificity (95 % and 95% respectively) (table - 25). Hence, the combination of these two parameters will increase the diagnostic accuracy in patients with heart failure.

In this study we evaluate the correlation between ejection fraction and clinical parameters like pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure and proportional pulse pressure by using Pearson correlation coefficient (r value). And the r value of pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure and proportional pulse pressure were 0.15, 0.68, 0.54, 0.74, and 0.67 respectively.

A statistically significant moderate positive correlation was observed between ejection fraction and pulse pressure, proportional pulse pressure, systolic blood pressure and diastolic blood pressure with p value <0.001*** which is highly significant. And also there was weak positive correlation observed between ejection fraction and pulse rate. Among these parameters the positive correlation(r value 0.74, p value <0.001) was more with pulse pressure i.e. when pulse pressure decreases ejection fraction also decreases and vice versa (table 26).

Scatter charts were used to show correlation between parameter and ejection fraction. Which showed good linear positive correlation for pulse pressure, systolic blood pressure and proportional pulse pressure and the coefficient of determination (r^2 value) were 0.55, 0.46 and 0.44 respectively (fig 16, 17 & 18).

After 2 months duration at the time of first follow up, the correlations between the significant parameters were reassessed. The results showed strong positive correlation between pulse pressure and ejection fraction (r value 0.76, p value <0.001).

The proportional pulse pressure and systolic blood pressure had moderate positive correlation (r value 0.72 & 0.66 respectively, p value <0.001). The diastolic blood pressure also showed moderate positive correlation (r value 0.63, p value <0.001) (table 27). Linear positive correlation were observed between ejection fraction and clinical parameters, which was shown in scattered charts (r^2 value 0.58, 0.52 & 0.44 respectively) (fig 18, 19, 20).

After optimization of treatment at second and third follow up, the correlations between the significant parameters were reassessed. A strong positive correlation between pulse pressure and systolic blood pressure with ejection fraction was noted (r value 0.82 & 0.79 respectively at p value <0.001). The proportional pulse pressure had moderate positive correlation at r value 0.70 and p value <0.001.

The ANOVA table test was used to test the acceptability of the model from a statistical perspective[65]. The Regression was 1898. This

was the information about the variation accounted for by the model. The Residual was 2372.62. Which was the information about the variation that is not accounted for by the model (table:30).

The model summary table reports the strength of the relationship between the model and the dependent variable (table 31). Its large value (0.44) indicates a strong relationship.R Square (0.44), the coefficient of determination, is the squared value of the multiple correlation coefficients. It shows that about half the variation in Ejection fraction was explained by this study model.

The coefficient of the regression line was used to derive outcome (Ejection Fraction) from proportional pulse pressure. Table 32 states that the expected Ejection fraction is equal to a+ b * Proportional pulse pressure (the linear regression equation is Y = a+ bX (y – Ejection Fraction, x – proportional pulse pressure)). If proportional pulse pressure is 25%, the predicted Ejection fraction would be equal to 6.679 + 0.91*25 calculated as 29.429 that is ejection fraction nearly 30%, which is predicted from proportional pulse pressure. It implies that in severe left ventricular dysfunction (Ejection fraction <30 %) the possibility of proportional pulse pressure being <25% is high vice versa.

During follow up every 2 months, the reassessed coefficient regression line showed improvement in proportional pulse pressure also associated with improvement in ejection fraction. It explained by decreasing b value (0.744 - 1.075,0.715 - 1.031, 0.736 - 1.014, 0.695 - 0.997) in each follow up (table33). So the proportional pulse pressure can be used as prognostic indicator for heart failure patients. The similar results were observed in the study “proportional pulse pressure – a non - invasive tool to assess the prognosis in advanced heart failure patients” by Miklosdekany et al[37,45.65].

To summarize, in our study, the clinical parameter studied in heart failure patients has resulted in

- Highly significant (p value <0.001) association observed between ejection fraction and breathlessness on exertion, orthopnea, elevated jugular venous pressure, proportional pulse pressure, systolic blood pressure, pulse pressure, third heart sound and basal crepitation. The association is more (Pearson chi square value is 72.11) for pulse pressure as compared to other parameter.

- The specificity for detecting heart failure was more for proportional pulse pressure and systolic blood pressure (95 % each). The pulse pressure showed good sensitivity and specificity 85%, 84% respectively, p value <0.001, OR – 30.55.

- The correlation of proportional pulse pressure, systolic blood pressure, and pulse pressure with ejection fraction showed moderate positive correlation in initial assessment. During follow up moderate positive correlation for proportional pulse pressure was maintained. The correlation of systolic blood pressure and pulse pressure with ejection fraction was increased to strong positive correlation. The correlation coefficient regression line was linear positive for all the three parameters.

- After optimization of treatment, the improvement in proportional pulse pressure correlates with increased ejection fraction.

CONCLUSION

CONCLUSION

- The proportional pulse pressure showed moderate positive correlation with ejection fraction.

- The proportional pulse pressure had good specificity for detecting patients with heart failure with reduced ejection fraction.

- The proportional pulse pressure was a good prognostic indicator in heart failure patients, low proportional pulse pressure associated with poor outcome.

LIMITATIONS

LIMITATIONS

- Sample size of the study was small.
- It should be done at community level and compared to control group (normal population).
- Period of study should be longer.

FUTURE PERSPECTIVES

FUTURE PROSPECTIVE

- A simple non-invasive, bedside clinical tool **- Proportional Pulse Pressure** is very helpful to predict the prognosis of heart failure patients.

- This is more useful when taken to the community level. And it is most useful in extremely rural (unapproachable rural area) areas where other investigative tools like echocardiogram are not available, where the clinician can confidently predict the outcome of heart failure patients with the simple tools of systolic blood pressure, pulse pressure and proportional pulse pressure.

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ANNEXURES

ANNEXURES - I

PROFORMA

"The correlation between proportional pulse pressure and ejection fraction in heart failure patients"

- Name DOA-
- Age DOD-
- Sex IP no-
- Diagnosis Address-
- NYHA classification
- Presenting complaints with duration:
- h/o orthopnea
- h/o weight gain
- Past h/o:
- Family h/0 –
- Drug h/o-

Examination

- General examination-

Jugular venous pressure-

- Vital signs - Temp

  Pulse

  Blood pressure

  Pulse pressure

  Proportional pulse pressure

- **Systemic examination-**

  CVS-

  RS-

  Abdomen-

  CNS-

- **INVESTIGATIONS :**

1. Basic investigation
2. Electrocardiography
3. Chest x ray
4. ECHO for ejection fraction

- Treatment details..
- Reassessment every 2months

ANNEXURES - II

PATIENT CONSENT FORM

STUDY TITLE:

"The correlation between proportional pulse pressure and ejection fraction in heart failure patients"

Study center:ESIC Medical College & PGIMSR

Participant Name :

Age:

Sex: IP No:

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to clarify all my queries and doubts and they have been answered to my satisfaction.

Investigator explained very well about the procedure and I am made aware of the safety, advantage and disadvantage of the technique.

I understand that my participation in the study is purely voluntary and that I am free to withdraw at anytime without giving any reason.

I have understood that the investigator, regulatory authorities and the ethics committee will have access to my health records both in respect to current study and any further research that may be conducted in relation to it, even if I decide to withdraw from the study.

I have understood that my identity will not be revealed in anyway and information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from the study.

Without any compulsion I am willing to give consent for the participation of myself in this study.

Date: Signature / thumb impression of patient

Place:

Patient name:

Signature of the investigator:

Name of the investigator:

INFORMATION TO PARTICIPANTS

Investigator: DR.A.P.JANANI

Study centre: ESIC Medical College &PGIMSR, K.K.Nagar, Chennai 78

STUDY TITLE:

"The correlation between proportional pulse pressure and ejection fraction in heart failure patients"

You are invited to take part in this research study. We have got approval from the IEC. You are asked to participate because you satisfy the eligibility criteria.

Rights and confidentiality:

The participation in this study is purely voluntary. You have every right not to participate in this study. All the data collected in this regard from you will be kept discretely and your name will not be revealed at any circumstances.

To whom you may contact?

If you have any doubts and clarification required you can call the doctor , JANANI.A.P.at the 7708740509 mobile number at any time.

Signature / Thumb Impression of Patient

Patient Name:

Signature of the Investigator : _____

Name of the Investigator : _____

ANNEXURES - II

ஒப்புதல் படிவம்

தலைப்பு:

"இருதய நோயளிகளுக்கான, நாடி அழுத்தம் மற்றும் இருதய செயல்படுகலுக்கு இடயேயான தொடர்புபற்றி அரிய நடத்தப்படும் ஆய்வு"

ஆய்வு மையம்: - ESIC மருத்துவ கல்லூரி & PGIMSR

பங்கேற்பாளர் பெயர் :

வயது :

ஆண் / பெண் :

நான் மேலே குறிப்பிட்ட ஆய்வின் செயல்முறை நோக்கம் புறிந்து கொண்டேன் என உறுதி அளிக்கிறேன். என் கேள்விகளையும் மற்றும் சந்தேகங்களையும் தெளிவுபடுத்த வாய்ப்பு அளிக்கப்பட்டது மற்றும் அவர்கள் அலித்த பதில் திருப்திகரமாக இருந்தது.

ஆய்வின் செயல்முறை பற்றிய விளக்கம் தெளிவாக கொடுக்கபட்டது. அதன் நன்மைகளும் மற்றும் தீமைகளும் எடுத்துறைத்தனர்.

இந்த ஆய்வில், என் சுயவிருப்பத்தின்படி, முழுமனதோடு பங்கேற்கிறேன். இந்த ஆய்விலிருந்து,

எந்த நேரத்திலும் எந்தவித காரணமும் சொல்லாமல் வெளியெற முழு சுதந்திரம் அளிக்கப்பட்டுள்ளது. எந்த ஆய்வின் மூலம் என் அடையாளஙளும் மற்றும் என் நோய் குறித்து தகவல்களும் வெளியிடப்படாது என்பதையும் அரிந்துகொண்டேன்.

எந்தவித கட்டாயமும் இன்றி என் சுயவிருப்பத்தின் பேரில்,

முழுமனதோடு இந்த ஆய்வில் பங்கேற்கதயாராக இருக்கிறேன்.

நோயாளியின் கையொப்பம் / பெருவிரல்ரேகை

நாள் :

இடம் :

ஆய்வாளர் பெயர் :

கையொப்பம் :

ANNEXURES – III

CERTIFICATE OF APPROVAL

TO

DR. A.P. Janani
PG in Department of General Medicine
ESIC Medical College & PGIMSR
KK Nagar, Chennai-78

Dear Dr. A.P. Janani,

The Institutional Ethics Committee of ESI PGIMSR reviewed and discussed you application for approval of the proposal entitled "The Correlation between Proportional Pulse Pressure and Ejection Fraction in Heart Failure Patients" , No. 02/20/11/2013.

The following members of the Ethics Committee were present in the meeting held on 20.11.2013 conducted at ESI PGIMSR, KK Nagar, Chennai-78.

S.No.	EC MEMBERS
1.	Dr. Saradha Suresh, Chairperson
2.	Dr.Kamalini Sridharan, Co-ordinator/ Prof. & HOD, Dept. of Anesthesia, ESI-PGIMSR.
3.	Prof. A.V. Srinivasan, EMERITUS Professor, TN MGR Medical University, EC Member
4.	Prof. C. Rajendiran, Department of General Medicine, EC Member
5.	Dr. N. Krishnan, Dept. of Anesthesia, EC Member
6.	Dr. K.S. Shekar, Dept. of Surgery, EC Member
7.	Dr. T.S. Swaminathan, Dept. of Radiology, EC Member
8.	Dr. C.V. Aravindan, Scientist, EC Member
9.	Dr. S. Dhanalakshmi, Dept. of OBG, EC Member
10.	Dr. A. Sundaram, Dept. of Medicine [Diabetologist], EC Member
11.	Dr. O.L. Naganath Babu, Dept. of surgical Gastroenterology, EC Member
12.	Dr. P. Venkatesan, Scientist, EC Member
13.	Shri. K M Venugopal, Advocate, EC Member

The proposal is approved to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and significant adverse effects occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

[DR. SARADHA SURESH]
CHAIRPERSON
ETHICAL COMMITTEE

KEY TO MASTER CHART

NYHA CLASS	
CHEYT PAIN	
SYNCOPE	
BOE	Breathlessness on exertion
PND	Paroxysmal nocturnal dyspnea
ORTHOPNEA	
DECREASED URINE OUTPUT	
ELEVATED JVP	
PEDAL EDEMA	
PR	Pulse rate
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
PP	Pulse Pressure
PPP %	Proportional pulse pressure
S3	Third heart sound
SYSTOLIC MURMUR	
BASAL CREPITATION	
EJECTION FRACTION	
NA	Sr. sodium
DM	Diabetes mellitus
CAD	Coronary artery disease
QRS WIDENIG	
CTR 55%	Cardio thoracic ratio

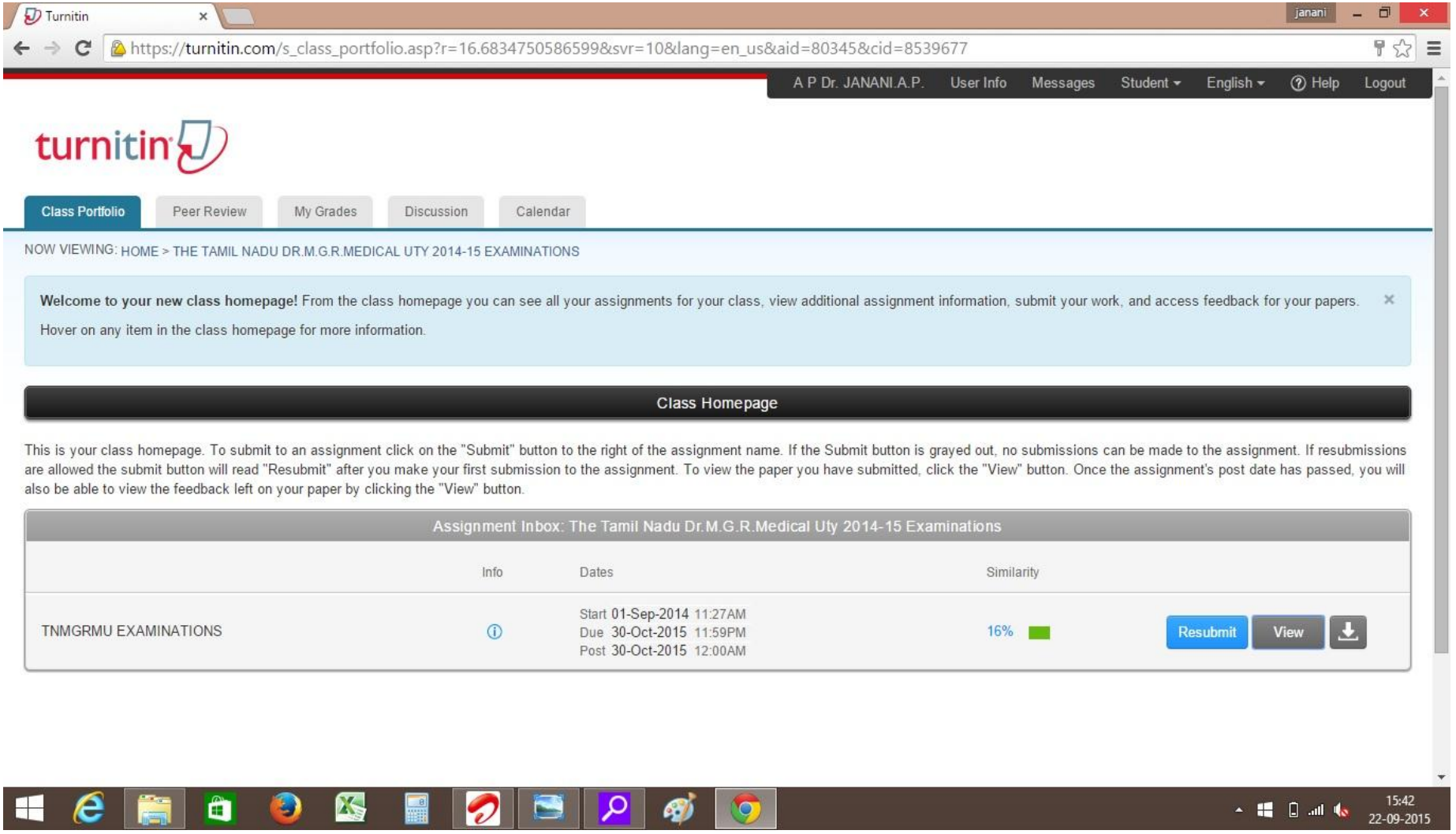
ANNEXURE - IV
MASTER CHART

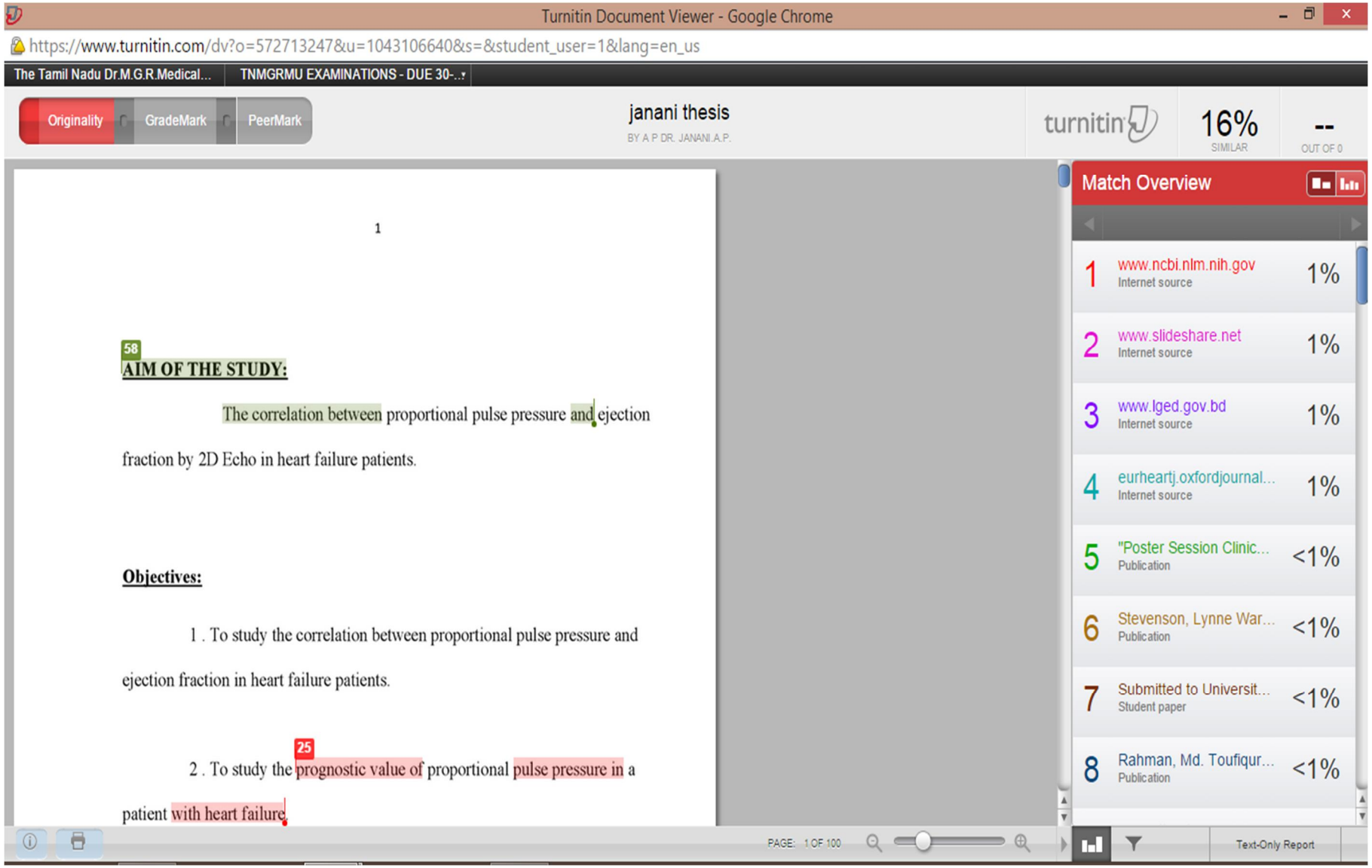
S.No	Name	Age	Sex	NYHA CLASS	CHEST PAIN	SYNCOPE	BOE	PND	ORTHOPNEA	DEGREASED URINE OUTPUT	ELEVATED JVP	PEDAL EDEMA	PR	SBP	DBP	PP	PPP %	S3	SYSTOLIC MURMUR	BASAL CREPITATION	EJECTION FRACTION	CAD	QRS WIDENING	CTR 55%	JVP ELEVATED 1	PEDAL EDEMA 1	SBP1	DBP1	PP1	PPP%1	S3 - 1	BASAL CREPITATION 1	EF1	JVP ELEVATED 2	PEDAL EDEMA 2	SBP2	DBP2	PP 2	PPP% 2	S3 - 2	BASAL CREPITATION 2	EF 2	JVP ELEVATED 3	PEDAL EDEMA 3	SBP 3	DBP 3	PP 3	PPP% 3	S3 - 3	BASAL CREPITATION 3	EF 3
1	DEVADOSS	60	Female	4	Y	N	Y	N	N	N	Y	N	99	90	70	20	22.222	N	N	Y	30	Y	N	N	Y	N	90	70	20	22.222	N	Y	30	Y	N	96	72	24	25	N	N	32	Y	N	96	72	24	25	N	N	32
2	PREMA	38	Female	4	N	N	Y	N	N	N	N	N	90	96	72	24	25	N	N	Y	32	Y	Y	Y	N	N	96	72	24	25	N	Y	32	N	N	100	70	30	30	N	N	35	N	N	100	70	30	30	N	N	35
3	CHANDRAN	44	Male	4	N	N	Y	N	Y	Y	Y	Y	70	80	60	20	25	Y	Y	N	29	Y	N	N	Y	N	80	60	20	25	Y	N	29	Y	N	86	60	26	30.233	N	N	32	N	N	86	60	26	30.233	N	N	32
4	Balan	45	Male	4	Y	N	Y	Y	Y	N	N	Y	72	86	60	26	30.233	N	N	Y	35	Y	Y	Y	Y	Y	90	60	30	33.333	N	Y	35	N	N	96	60	36	37.5	N	Y	37	N	N	96	60	36	37.5	N	Y	37
5	Murugan	45	Male	4	Y	N	Y	N	N	N	Y	N	60	90	70	20	22.222	N	N	Y	27	Y	Y	Y	Y	N	90	70	20	22.222	N	Y	27	Y	N	96	72	24	25	N	N	29	Y	N	96	72	24	25	N	N	29
6	Mohan	52	Male	4	Y	N	Y	N	N	N	N	N	65	88	64	24	27.273	N	Y	Y	26	Y	Y	Y	N	N	90	64	26	28.889	N	Y	28	N	N	96	64	32	33.333	N	Y	31	N	N	96	64	32	33.333	N	Y	31
7	NAVANEEDHAM	67	Female	4	N	Y	Y	Y	Y	N	Y	Y	101	106	82	24	22.642	Y	N	Y	27	Y	Y	Y	Y	Y	100	78	22	22	Y	Y	27	Y	Y	100	70	30	30	N	Y	30	Y	Y	100	70	30	30	N	N	30
8	RAMACHANDRA	50	Male	4	Y	N	Y	N	N	N	N	N	120	90	66	24	26.667	N	N	Y	29	Y	Y	N	N	N	90	66	24	26.667	N	Y	29	N	N	96	66	30	31.25	N	Y	31	N	N	96	66	30	31.25	N	Y	31
9	VEERAIYAN	43	Male	3	N	N	Y	Y	Y	N	Y	N	89	90	70	20	22.222	Y	N	N	22	Y	N	Y	Y	N	90	70	20	22.222	Y	N	22	Y	N	96	70	26	27.083	Y	N	25	Y	N	96	70	26	27.083	Y	N	25
10	ANJALAI	66	Female	4	Y	N	Y	Y	Y	N	Y	Y	78	78	54	24	30.769	N	N	Y	35	Y	Y	Y	Y	Y	78	54	24	30.769	N	Y	35	Y	Y	96	64	32	33.333	N	N	35	Y	Y	96	64	32	33.333	N	N	35
11	Vengaiah	65	Male	3	Y	Y	Y	N	N	N	N	N	63	120	88	32	26.667	N	N	Y	35	Y	Y	Y	N	N	120	88	32	26.667	N	Y	35	N	N	126	88	38	30.159	N	Y	37	N	N	126	88	38	30.159	N	Y	37
12	MARIVALEN	35	Male	4	Y	N	Y	N	Y	N	Y	N	103	100	76	24	24	N	N	Y	28	N	Y	Y	Y	N	100	76	24	24	N	Y	28	Y	N	100	72	28	28	N	Y	30	N	N	100	72	28	28	N	Y	30
13	RAVICHANDRAN	75	Male	4	N	N	Y	Y	Y	N	N	N	79	64	50	14	21.875	Y	Y	N	28	Y	N	N	N	N	64	50	14	21.875	Y	N	25	N	N	86	60	26	30.233	N	N	27	N	N	86	60	26	30.233	N	N	27
14	Lakshmi	60	Female	4	N	N	Y	N	Y	Y	Y	Y	88	104	72	32	30.769	N	N	Y	29	Y	Y	Y	Y	Y	104	72	32	30.769	N	Y	29	Y	Y	100	72	28	28	N	N	29	Y	Y	100	72	28	28	N	N	29
15	Sivagangai	60	Female	4	N	N	Y	N	N	N	Y	N	98	96	72	24	25	N	N	Y	21	Y	Y	Y	Y	N	90	72	18	20	N	Y	21	Y	N	90	70	20	22.222	N	Y	23	Y	N	90	70	20	22.222	N	Y	23
16	Agila Devi	47	Female	4	N	N	Y	N	N	N	N	N	92	92	72	20	21.739	N	Y	Y	19	Y	Y	Y	N	N	92	72	20	21.739	N	Y	19	N	N	90	72	18	20	N	Y	20	N	N	90	72	18	20	N	Y	20
17	Mohamed Naniy	62	Male	4	Y	Y	Y	Y	Y	Y	Y	Y	105	110	84	26	23.636	Y	N	Y	23	Y	Y	Y	Y	Y	100	80	20	20	Y	Y	25	Y	Y	100	72	28	28	Y	N	28	Y	Y	100	72	28	28	Y	N	28
18	Elumalai	62	Male	4	N	N	Y	N	N	N	N	N	108	95	60	35	36.842	N	N	Y	34	Y	Y	Y	N	N	90	60	30	33.333	N	Y	34	N	N	100	66	34	34	N	Y	35	N	N	100	66	34	34	N	Y	35
19	Arumugam	54	Male	4	N	N	Y	N	Y	N	Y	N	100	120	88	32	26.667	Y	N	N	35	Y	Y	Y	Y	N	120	88	32	26.667	Y	N	35	Y	N	120	86	34	28.333	N	N	37	Y	N	120	86	34	28.333	N	N	37
20	Dhanam	56	Female	4	N	N	Y	Y	Y	Y	N	Y	89	90	70	20	22.222	N	N	Y	33	Y	Y	Y	N	Y	90	70	20	22.222	N	Y	33	N	Y	100	76	24	24	N	N	35	N	Y	100	76	24	24	N	N	35
21	Aruldas	33	Male	3	Y	N	Y	N	N	N	N	N	102	110	74	36	32.727	N	N	Y	30	N	Y	Y	N	N	100	74	26	26	N	Y	30	N	N	100	72	28	28	N	Y	32	N	N	100	72	28	28	N	Y	32
22	Unnamalai	72	Female	4	Y	Y	Y	Y	Y	Y	Y	Y	88	92	70	22	23.913	N	N	Y	28	Y	N	N	Y	Y	92	70	22	23.913	N	Y	28	Y	N	96	72	24	25	N	Y	30	Y	N	96	72	24	25	N	Y	30
23	Muthamaal	55	Female	3	N	N	Y	N	N	N	N	N	78	96	70	26	27.083	Y	Y	N	29	Y	Y	Y	N	N	96	70	26	27.083	Y	N	29	N	N	100	70	30	30	N	N	32	N	N	100	70	30	30	N	N	32
24	Kadher Bivi	74	Female	4	Y	Y	Y	Y	Y	Y	Y	Y	103	100	70	30	30	N	N	Y	24	Y	N	N	Y	Y	100	70	30	30	N	Y	24	Y	N	96	70	26	27.083	N	Y	26	Y	N	96	70	26	27.083	N	Y	26
25	Munusamy	63	Male	3	N	N	Y	Y	Y	N	Y	N	76	90	68	22	24.444	N	N	Y	25	N	Y	Y	Y	N	90	68	22	24.444	N	Y	25	Y	N	94	70	24	25.532	N	N	27	Y	N	94	70	24	25.532	N	N	27
26	Chinnaraj	72	Male	4	N	Y	N	N	N	N	N	N	110	128	88	40	31.25	N	Y	Y	35	Y	Y	Y	N	N	130	88	42	32.308	N	Y	35	N	N	136	86	50	36.765	N	N	38	N	N	136	86	50	36.765	N	N	38
27	Mangala lakshmi	75	Female	4	N	N	Y	Y	Y	N	Y	N	86	120	86	34	28.333	Y	N	Y	34	Y	Y	Y	N	N	120	86	34	28.333	Y	Y	34	N	N	120	82	38	31.667	Y	Y	35	N	N	120	82	38	31.667	Y	Y	35
28	Nagalingam	58	Male	4	N	N	Y	Y	Y	N	Y	Y	82	90	70	20	22.222	N	N	Y	34	N	Y	Y	Y	Y	90	70	20	22.222	N	Y	34	Y	Y	96	64	32	33.333	N	Y	35	Y	Y	96	64	32	33.333	N	Y	35
29	Navaneethamal	67	Female	3	Y	Y	Y	Y	Y	N	Y	N	92	118	88	30	25.424	Y	N	N	33	Y	Y	Y	Y	N	118	88	30	25.424	Y	N	33	Y	N	120	82	38	31.667	Y	N	35	Y	N	120	82	38	31.667	Y	N	35
30	Dhamodharan	74	Male	3	N	Y	Y	N	N	N	N	N	92	118	86	32	27.119	N	N	Y	32	Y	N	N	Y	N	118	86	32	27.119	N	Y	32	Y	Y	120	82	38	31.667	N	Y	34	N	Y	120	82	38	31.667	N	N	34
31	Jeyaraman	52	Male	4	N	N	Y	N	Y	N	Y	Y	115	90	70	20	22.222	N	N	Y	30	Y	Y	Y	Y	Y	90	70	20	22.222	N	Y	30	Y	Y	90	70	20	22.222	N	Y	32	Y	Y	90	70	20	22.222	N	Y	32
32	Kaneiyan	65	Male	4	Y	N	Y	N	N	N	N	N	96	110	86	24	21.818	N	N	Y	28	Y	Y	Y	N	N	110	80	30	27.273	N	Y	30	N	N	100	70	30	30	N	Y	30	N	N	100	70	30	30	N	Y	30
33	Nagadas	67	Male	3	Y	Y	Y	N	N	N	N	N	60	110	74	36	32.727	Y	Y	N	34	Y	N	N	N	N	130	88	42	32.308	Y	N	35	N	N	110	74	36	32.727	Y	N	35	N	N	110	74	36	32.727	Y	N	35
34	Ramaiah	65	Male	4	N	N	Y	N	Y	N	Y	N	105	110	86	24	21.818	N	N	Y	25	N	Y	Y	Y	N	90	70	20	22.222	N	Y	27	Y	N	110	86	24	21.818	N	Y	29	Y	N	110	86	24	21.818	N	N	29
35	Veeraiah	43	Male	4	Y	N	Y	Y	Y	Y	Y	Y	66	92	70	22	23.913	N	N	Y	26	Y	N	N	Y	Y	100	70	30	30	N	Y	29	Y	Y	92	70	22	23.913	N	N	26	Y	Y	92	70	22	23.913	N	N	26
36	Krishnaveni	66	Male	3	Y	N	Y	Y	Y	Y	Y	Y	76	96	72	24	25	N	Y	Y	27	N	Y	Y	Y	Y	100	70	30	30	N	Y	30	N	Y	96	72	24	25	N	Y	27	N	Y	96	72	24	25	N	Y	27
37	Jyotheeshwari	65	Female	4	Y	N	Y	Y	Y	N	N	N	74	116	88	28	24.138	Y	N	Y	35	N	Y	Y	N	N	110	80	30	27.273	Y	Y	36	N	N	116	88	28	24.138	Y	Y	35	N	N	116	88	28	24.138	Y	N	35
38	Kaveri	63	Female	4	N	N	Y	N	N	N	N	N	96	110	80	30	27.273	N	N	Y	30	N	Y	Y	N	N	100	70	30	30	N	Y	30	N	N	110	80	30	27.273	N	Y	30	N	N	110	80	30	27.273	N	Y	30
39	Pappa	60	Female	3	N	N	Y	Y	Y	N	Y	N	85	128	88	40	31.25	Y	N	N	33	Y	Y	N	Y	N	128	88	40	31.25	Y	N	35	Y	N	128	88	40	31.25	Y	N	33	Y	Y	128	88	40	31.25	Y	N	33
40	Jeyaraman	55	Male	4	N	N	Y	N	N	N	N	N	84	120	88	32	26.667	N	N	Y	32	N	Y	Y	Y	N	128	88	40	31.25	N	Y	35	Y	N	120	88	32	26.667	N	Y	32	Y	N	120	88	32	26.667	N	Y	32
41	Srinathan	46	Male	3	N	N	Y	Y	Y	Y	Y	Y	80	112	78	34	30.357	N	N	Y	31	N	Y	Y	Y	Y	130	88	42	32.308	N	Y	34	Y	Y	112	78	34	30.357	N	Y	31	Y	Y	112	78	34	30.357	N	Y	31
42	Rajathi	68	Female	3	N	N	Y	N	N	N	Y	N	109	100	74	26	26	N	N	Y	26	N	Y	Y	Y	N	100	70	30	30	N	Y	30	Y	N	100	74	26	26	N	Y	28	Y	N	100	74	26	26	N	Y	28
43	Chandra	52	Female	3	Y	N	Y	N	Y	N	Y	N	90	100	70	30	30	Y	Y	N	27	N	Y	Y	Y	N	100	70	30	30	Y	N	29	Y	N	100	70	30	30	Y	N	27	Y	N	100	70	30	30	Y	N	27
44	Mary Kamalam	65	Female	4	N	N	Y	N	N	N	N	N	76	102	76	26	25.49	N	N	Y	29	Y	N	N	N	N	100	70	30	30	N	Y	30	N	N	102	76	26	25.49	N	Y	29	N	N	102	76	26	25.49	N	N	29
45	Subraiya bu	72	Male	3	N	N	Y	Y	Y	N	Y	N	60	90	70	20	22.222	N	N	Y	22	Y	N	N	Y	N	90	70	20	22.222	N	Y	22	Y	N	86	68	18	20.93	N	Y	19	Y	N	86	68	18	20.93	N	Y	19
46	Latha	52	Female	4	Y	Y	Y	N	Y	N	Y	N	64	96	72	24	25	N	Y	Y	24	Y	N	N	Y	N	100	70	30	30	N	Y	25	Y	N	96	72	24	25	N	Y	24	Y	Y	96	72	24	25	N	Y	24
47	Papathi	64	Female	4	Y	N	Y	Y	Y	Y	Y	Y	119	110	84	26	23.636	Y	N	Y	23	Y	N	N	Y	Y	110	82	28	25.455	Y	Y	26	N	N	110	84	26	23.636	Y	Y	25	N	N	110	84	26	23.636	Y	N	25
48	Kandhan	64	Male	3	N	N	Y	Y	Y	N	Y	N	98	128	88	40	31.25	N	N	Y	29	N	Y	Y	Y	N	128	88	40	31.25	N	Y	30	Y	N	100	70	30	30	N	Y	27	Y	N	100	70	30	30	N	Y	27
49	Sukumaran	48	Male	4	N	N	Y	Y	Y	N	Y	Y	79	90	70	20	22.222	Y	N	N	27	N	Y	Y	Y	Y	90	70	20	22.222	Y	N	25	Y	Y	92	70	22	23.913	Y	N	27	Y	N	92	70	22	23.913	Y	N	27
50	Jeyaraman	64	Male	4	N	N	Y	Y	Y	N	N	Y	80	96	72	24	25	N	N	Y	35	Y	N	N	N	Y	90	70	20	22.222	N	Y	30	N	Y	110	72	38	34.545	N	Y	35	N	Y	110	72	38	34.545	N	Y	35
51	Saratha	60	Female	3	Y	N	Y	Y	Y	N	Y	N	98	106	80	26	24.528	N	N	Y	30	Y	N	N	Y	N	106	80	26	24.528	N	Y	30	N	N	100	78	22	22	N	Y	27	N	N	100	78	22	22	N	N	27
52	Ismail	62	Male	4	Y	N	Y	Y	Y	N	N	N	65	104	80	24	23.077	N	N	Y	29	Y	N	N	N	N	104	80	24	23.077	N	Y	29	N	N	96	74	22	22.917	N	Y	27	N	N	96	74	22	22.917	N	Y	27
53	Mohan	64	Male	3	Y	N	Y	N	N	N	Y	N	85	100	78	22	22	Y	Y	N	24	N	Y	Y	N	N	100	78	22	22	Y	N	24	N	N	86	68	18	20.93	Y	N	22	NN	N	86	68	18	20.93	Y	N	22
54	Inderani	60	Female	3	N	Y	Y	N	Y	N	Y	Y	84	102	78	24	23.529	N	N	Y	25	Y	Y	N	Y	Y	102	78	24	23.529	N	Y	25	Y	Y	94	72	22	23.404	N	Y	24	N	Y	94	72	22	23.404	N	Y	24
55	Rajasekaran	64	Male	4	N	N	Y	N	N	N	N	N	100	98	72	26	26.531	N	N	Y	30	Y	Y	N	N	N	98	72	26	26.531	N	Y	30	N	N	92	72	20	21.739	N	Y	27	N	N	92	72	20	21.739	N	Y	27
56	Ramalingam	76	Male	4	N	N	Y	N	Y	N	Y	N	78	94	72	22	23.404	N	Y	Y	30	Y	N	N	Y	N	94	72	22	23.404	N	Y	30	Y	N	90	72	18	20	N	Y	28	N	N	90	72	18	20	N	Y	28
57	Devaraj	70	Male	4	N	N	Y	N	N	N	N	N	96	128	88	40	31.25	Y	N	Y	30	Y	Y	Y	N	N	128	88	40	31.25	Y	Y	30	N	N	110	88	22	20	Y	Y	27	N	N	110	88	22	20	Y	N	27
58	Mohamed Shoiel	66	Male	3	N	N	Y	Y	Y	N	Y	N	72	98	72	26	26.531	N	N	Y	34	N	Y	Y	Y	N	98	72	26	26.531	N	Y	34	Y	N	118	86	32	27.119	N	Y	33	Y	Y	118	86	32	27.119	N	Y	33
59	Muniyandi	52	Male	4	N	Y	Y	Y	Y	Y	Y	Y	74	120	88	32	26.667	Y	N	N	32	Y	N	N	N	N	110	88	22	20	Y	N	32	N	N	106	80	26	24.528	Y	N	30	death									
60	Kuppammal	74	Female	3	Y	Y	Y	Y	Y	N	Y	N	104	100	72	28	28	N	N	Y	32	Y	Y	Y	Y	N	100	72	28	28	N	Y	32	Y	N	100	72	28	28	N	Y	32	death									
61	Francis	65	Male	3	N	N	Y	N	Y	N	Y	N	66	90	70	20	22.222	N	N	Y	18	Y	N	N	Y	N	90	70	20	22.222	N	Y	18	Y	Y	86	70	16	18.605	N	Y	18	death									
62	Murthy	63	Male	3	N	N	Y	N	N	N	Y	N	68	102	78	24	23.529	N	N	Y	21	Y	Y	Y	Y	N	102	78	24	23.529	N	Y	21	N	N	90	72	18	20	N	Y	21	death									
63	Rajendran	52	Male	4	N	N	Y	N	N	N	Y	Y	88	90	70	20	22.222	Y	Y	N	25	Y	Y	Y	Y	Y	90	70	20	22.222	Y	N	25	Y	Y	90	70	20	22.222	Y	N	25	death									
64	Ranganayagi	58	Female	4	Y	N	Y	N	Y	N	Y	N	91	100	70	30	30	N	N	Y	29	Y	Y	Y	Y	N	100	70	30	30	N	Y	29	Y	N	100	70	30	30	N	Y	29	death									
65	Meena	45	Female	4	Y	N	Y	N	N	N	Y	N	104	92	70	22	23.913	N	N	Y	27	Y	Y	Y	N	N	92	70	22	23.913	N	Y	27	N	N	92	70	22	23.913	N	Y	27	death									
66	Angamuthu	67	Male	3	N	N	Y	Y	Y	N	Y	N	98	110	84	26	23.636	N	Y	Y	29	Y	Y	N	Y	Y	110	84	26	23.636	N	Y	29	Y	Y	106	84	22	20.755	N	Y	29	Y	Y	106	84	22	20.755	N	N	29
67	Navaneethamal	67	Female	3	N	N	Y	N	Y	N	N	N	60	92	70	22	23.913	Y	N	Y	29	Y	N	Y	N	N	92	70	22	23.913	Y	Y	29	N	N	92	70	22	23.913	Y	Y	29	N	N	92	70	22	23.913	Y	Y	29
68	Jeyaraman	54	Male	4	Y	N	Y	Y	Y	Y	Y	Y	68	92	70	22	23.913	N	N	Y	25	Y	Y	Y	Y	Y	92	70	22	23.913	N	Y	28	N	N	92	70	22	23.913	N	Y	28	N	N	92	70	22	23.913	N	N	28
69	Kuppusamy	77	Male	4	Y	N	Y	N	N	N	Y	N	63	90	70	20	22.222	Y	N	N	26	Y	Y	Y	Y	N	90	70	20	22.222	Y	N	26	Y	N	90	70	20	22.222	Y	N	26	Y	N	90	70	20	22.222	Y	N	26
70	Kathavarayan	52	Male	3	N	N	Y	N	Y	N	Y	N	70	96	72	24	25	N	N	Y	26	N	Y	Y	Y	N	96	72	24	25	N	Y	26	Y	N	96	72	24	25	N	Y	26	Y	N	96	72	24	25	N	Y	26
71	Badma	75	Female	3	N	N	Y	N	N	N	N	N	76	110	70	40	36.364	N	N	Y	35	Y	N	N	N	N	110	70	40	36.364	N	Y	35	N	N	110	70	40	36.364	N	Y	35	N	N	110	70	40	36.364	N	Y	35
72	Inderani	60	Female	4	N	N	Y	N	Y	N	N	N	72	98	72	26	26.531	N	N	Y	30	Y	Y	Y	N	N	98	72	26	26.531	N	Y	30	N	N	98	72	26	26.531	N	Y	30	N	N	98	72	26	26.531	N	Y	30
73	Duraisamy	68	Male	4	N	N	Y	N	Y	N	N	N	80	128	88	40	31.25	Y	Y	N	30	Y	Y	Y	N	N	128	88	40	31.25	Y	N	30	N	N	102	76	26	25.49	Y	N	30	N	N	102	76	26	25.49	Y	N	30
74	Kathirvel	65	Male	4	N	N	Y	N	N	N	N	N	89	120	88	32	26.667	N	N	Y	31	Y	Y	Y	Y	N	120	88	32	26.667	N	Y	31	Y	N	106	82	24	22.642	N	Y	31	Y	N	106	82	24	22.642	N	N	31
75	Selvamani	50	Male	3	N	Y	Y	N	N	N	N	N	84	98	72	26	26.531	N	N	Y	34	Y	Y	Y	N	N	98	72	26	26.531	N	Y	32	N	N	98	72	26	26.531	N	Y	32	N	N	98	72	26	26.531	N	Y	32
76	Ramalingam	75	Male	4	N	N	Y	N	Y	N	Y	N	82	90	70	20	22.222	N	Y	Y	26	Y	Y	Y	Y	Y	90	70	20	22.222	N	Y	26	Y	N	90	70	20	22.222	N	Y	26	Y	N	90	70	20	22.222	N	N	27
77	Sivashankar	65	Male	4	Y	N	Y	N	Y	N	Y	Y	96	102	78	24	23.529	Y	N	Y	26	Y	Y	Y	Y	Y	96	72	24	25	Y	Y	26	Y	Y	96	72	24	25	Y	Y	26	Y	Y	96	72	24	25	Y	Y	26

ANNEXURE - IV
MASTER CHART

S.No	Name	Age	Sex	NYHA CLASS	CHEST PAIN	SYNCOPE	BOE	PND	ORTHOPNEA	DEGREASED URINE OUTPUT	ELEVATED JVP	PEDAL EDEMA	PR	SBP	DBP	PP	PPP %	S3	SYSTOLIC MURMUR	BASAL CREPITATION	EJECTION FRACTION	CAD	QRS WIDENING	CTR 55%	JVP ELEVATED 1	PEDAL EDEMA 1	SBP1	DBP1	PP1	PPP%1	S3 - 1	BASAL CREPITATION 1	EF1	JVP ELEVATED 2	PEDAL EDEMA 2	SBP2	DBP2	PP 2	PPP% 2	S3 - 2	BASAL CREPITATION 2	EF 2	JVP ELEVATED 3	PEDAL EDEMA 3	SBP 3	DBP 3	PP 3	PPP% 3	S3 - 3	BASAL CREPITATION 3	EF 3
78	Rajan	40	Male	3	Y	N	Y	N	Y	N	Y	N	60	96	72	24	25	N	N	Y	27	Y	Y	Y	Y	N	96	72	24	25	N	Y	27	N	N	96	72	24	25	N	Y	27	N	N	96	72	24	25	N	Y	27
79	Prema	55	Female	4	N	N	Y	N	N	N	Y	N	80	90	70	20	22.222	Y	N	N	24	N	Y	Y	Y	N	90	70	20	22.222	Y	N	24	Y	N	90	70	20	22.222	Y	N	24	Y	N	90	70	20	22.222	Y	N	24
80	Nagalingam	58	Male	4	N	N	Y	N	Y	N	N	N	82	98	72	26	26.531	N	N	Y	30	Y	N	N	N	N	98	72	26	26.531	N	Y	30	N	N	98	72	26	26.531	N	Y	30	N	N	98	72	26	26.531	N	Y	30
81	Ismail	61	Male	3	Y	N	Y	N	N	N	N	N	78	128	88	40	31.25	N	N	Y	30	Y	Y	Y	N	N	128	88	40	31.25	N	Y	30	N	N	128	88	40	31.25	N	Y	30	N	N	128	88	40	31.25	N	N	30
82	Manimegalai	63	Female	4	N	N	Y	Y	Y	Y	N	Y	114	100	70	30	30	N	N	Y	34	Y	N	N	N	Y	100	70	30	30	N	Y	34	N	Y	100	70	30	30	N	Y	34	N	Y	100	70	30	30	N	Y	34
83	Srinivasan	70	Male	4	N	N	Y	N	N	N	Y	N	98	96	72	24	25	Y	Y	N	27	N	Y	Y	Y	N	96	72	24	25	Y	N	27	N	N	96	72	24	25	Y	N	27	N	N	96	72	24	25	Y	N	27
84	Yesupudhan	70	Male	3	N	N	Y	Y	Y	Y	Y	Y	65	98	72	26	26.531	N	N	Y	29	Y	Y	Y	Y	Y	98	72	26	26.531	N	Y	29	Y	Y	96	72	24	25	N	Y	29	Y	Y	96	72	24	25	N	Y	29
85	Mariammal	60	Female	4	N	N	Y	Y	N	N	Y	N	68	110	84	26	23.636	N	N	Y	29	Y	Y	Y	Y	N	100	74	26	26	N	Y	29	Y	N	96	74	22	22.917	N	Y	29	Y	N	96	74	22	22.917	N	Y	29
86	Anjalaachi	65	Female	4	N	N	Y	Y	Y	N	Y	N	72	96	72	24	25	N	Y	Y	28	N	Y	Y	N	N	96	72	24	25	N	Y	28	N	N	96	72	24	25	N	Y	28	N	N	96	72	24	25	N	Y	28
87	Haji Mohamed	60	Male	3	N	Y	Y	N	Y	N	Y	N	78	96	72	24	25	Y	N	Y	26	Y	Y	Y	Y	Y	96	72	24	25	Y	Y	26	Y	Y	96	72	24	25	Y	Y	26	Y	Y	96	72	24	25	Y	Y	26
88	Balakrishnan	56	Male	4	N	N	Y	N	N	N	Y	N	70	102	78	24	23.529	N	N	Y	24	Y	N	N	Y	N	94	70	24	25.532	N	Y	26	Y	N	94	70	24	25.532	N	Y	26	Y	N	94	70	24	25.532	N	N	26
89	Pappa	60	Female	3	Y	N	Y	N	Y	N	Y	N	117	96	72	24	25	Y	N	N	28	Y	Y	Y	Y	N	96	72	24	25	Y	N	28	Y	Y	96	72	24	25	Y	N	28	Y	Y	96	72	24	25	Y	N	28
90	Viji	40	Female	4	N	N	Y	N	N	N	Y	N	70	110	84	26	23.636	N	N	Y	24	Y	Y	Y	Y	N	110	84	26	23.636	N	Y	24	N	N	96	70	26	27.083	N	Y	24	N	N	96	70	26	27.083	N	Y	24
91	Balagurusamy	71	Male	3	Y	N	Y	N	N	N	Y	N	79	90	70	20	22.222	N	N	Y	26	Y	N	N	Y	N	90	70	20	22.222	N	Y	26	Y	N	90	70	20	22.222	N	Y	26	Y	N	90	70	20	22.222	N	Y	26
92	Murugan	75	Male	4	N	N	Y	Y	Y	N	N	N	90	92	70	22	23.913	N	N	Y	29	N	Y	Y	N	N	92	70	22	23.913	N	Y	29	N	N	92	70	22	23.913	N	Y	29	N	N	92	70	22	23.913	N	Y	29
93	Mariammal	71	Female	3	N	N	Y	Y	Y	Y	N	Y	86	90	68	22	24.444	Y	Y	N	29	Y	N	N	Y	Y	90	68	22	24.444	Y	N	29	Y	Y	90	68	22	24.444	Y	N	29	Y	Y	90	68	22	24.444	Y	N	29
94	Annamary	65	Female	3	N	N	Y	N	N	N	N	N	84	100	76	24	24	N	N	Y	27	N	Y	Y	N	N	100	76	24	24	N	Y	27	N	N	100	76	24	24	N	N	27	N	N	100	76	24	24	N	N	27
95	Chellaiah pillai	73	Male	4	N	N	Y	Y	Y	Y	Y	Y	82	90	70	20	22.222	N	N	Y	21	N	Y	Y	N	Y	90	70	20	22.222	N	Y	21	N	Y	90	70	20	22.222	N	Y	21	N	Y	90	70	20	22.222	N	Y	23
96	Khader beeve	75	Female	3	N	Y	Y	Y	Y	Y	Y	Y	112	94	72	22	23.404	N	Y	Y	25	N	Y	Y	Y	Y	94	72	22	23.404	N	Y	25	Y	Y	94	72	22	23.404	N	Y	25	Y	Y	94	72	22	23.404	N	Y	25
97	Karupaiah	72	Male	3	N	N	Y	Y	Y	N	Y	N	78	120	88	32	26.667	Y	N	Y	29	Y	Y	N	Y	N	120	88	32	26.667	Y	Y	29	Y	N	108	78	30	27.778	Y	Y	29	Y	N	108	78	30	27.778	Y	N	29
98	Subburayan	72	Male	3	Y	N	Y	Y	Y	N	N	N	79	100	74	26	26	N	N	Y	29	N	Y	Y	N	N	100	74	26	26	N	Y	29	N	N	100	74	26	26	N	Y	29	N	N	100	74	26	26	N	Y	29
99	Shenbagam	55	Female	3	N	N	Y	Y	Y	N	Y	N	105	90	68	22	24.444	Y	N	N	27	N	Y	Y	Y	N	90	68	22	24.444	Y	N	27	Y	Y	90	68	22	24.444	Y	N	27	Y	Y	90	68	22	24.444	Y	N	27
100	Gowrishankar	65	Male	4	N	N	Y	N	N	N	N	N	76	98	72	26	26.531	N	N	Y	35	N	Y	Y	N	N	98	72	26	26.531	N	Y	35	N	N	98	72	26	26.531	N	Y	35	N	N	98	72	26	26.531	N	Y	35
101	Murthy	64	Male	2	N	N	Y	N	N	N	N	N	74	112	78	34	30.357	N	N	Y	36	N	Y	Y	N	N	112	78	34	30.357	N	Y	36	N	N	112	78	34	30.357	N	Y	36	N	N	112	78	34	30.357	N	Y	36
102	Duraisamy	61	Male	2	N	N	Y	Y	Y	N	Y	Y	80	114	80	34	29.825	N	N	Y	33	Y	N	N	Y	Y	114	80	34	29.825	N	Y	33	Y	Y	118	80	38	32.203	N	Y	35	Y	Y	118	80	38	32.203	N	Y	35
103	Kannan	65	Male	3	Y	N	Y	N	N	N	N	N	100	140	90	50	35.714	Y	Y	N	38	Y	N	N	N	Y	140	90	50	35.714	Y	N	38	N	Y	140	90	50	35.714	Y	N	38	N	Y	140	90	50	35.714	Y	N	38
104	kuppan	40	Male	3	N	N	Y	Y	Y	N	N	N	86	140	100	40	28.571	N	N	Y	39	Y	N	N	N	N	140	100	40	28.571	N	Y	39	N	N	140	100	40	28.571	N	N	39	N	N	140	100	40	28.571	N	N	39
105	Mani	56	Male	3	Y	N	Y	N	N	N	N	N	86	150	110	40	26.667	N	N	Y	37	Y	N	N	N	N	150	110	40	26.667	N	Y	37	N	N	140	86	54	38.571	N	Y	37	N	N	140	86	54	38.571	N	Y	37
106	Thirunavukarasu	42	Male	3	Y	N	Y	Y	N	N	N	N	76	138	90	48	34.783	N	Y	Y	38	N	Y	Y	N	N	138	90	48	34.783	N	Y	38	N	N	138	90	48	34.783	N	Y	38	N	N	138	90	48	34.783	N	Y	38
107	Arivalagzhan	63	Male	3	Y	N	N	N	N	N	N	N	108	120	88	32	26.667	Y	N	Y	36	N	Y	Y	N	N	120	88	32	26.667	Y	Y	36	N	N	120	88	32	26.667	Y	Y	36	N	N	120	88	32	26.667	Y	N	36
108	Pachiammal	83	Female	2	N	N	Y	Y	Y	N	Y	Y	84	112	78	34	30.357	N	N	Y	35	Y	N	N	Y	Y	112	78	34	30.357	N	Y	35	Y	Y	118	80	38	32.203	N	Y	38	Y	Y	118	80	38	32.203	N	Y	38
109	Badma	55	Female	3	N	N	Y	Y	Y	N	N	Y	71	128	88	40	31.25	Y	N	N	39	Y	N	N	N	Y	128	88	40	31.25	Y	N	39	N	Y	128	88	40	31.25	Y	N	39	N	Y	128	88	40	31.25	Y	N	39
110	Ramalingam	59	Male	3	N	N	Y	N	N	N	N	N	86	120	80	40	33.333	N	N	Y	38	Y	N	N	N	N	120	80	40	33.333	N	Y	38	N	N	120	80	40	33.333	N	Y	38	N	N	120	80	40	33.333	N	Y	38
111	Selvanathan	39	Male	3	N	N	Y	Y	Y	N	Y	N	118	110	86	24	21.818	N	N	Y	36	N	Y	Y	Y	N	110	86	24	21.818	N	Y	36	Y	N	110	86	24	21.818	N	Y	36	Y	N	110	86	24	21.818	N	Y	36
112	Kalyani	48	Female	3	Y	N	Y	N	N	N	N	N	98	118	80	38	32.203	N	N	Y	36	Y	Y	N	N	N	118	80	38	32.203	N	Y	36	N	N	118	80	38	32.203	N	Y	36	N	N	118	80	38	32.203	N	N	36
113	Nagaraj	42	Male	3	N	Y	Y	N	N	N	N	N	70	116	86	30	25.862	N	Y	N	35	Y	Y	N	N	N	116	86	30	25.862	N	N	35	N	N	116	86	30	25.862	N	N	35	N	N	116	86	30	25.862	N	N	35
114	Velammal	65	Female	3	Y	N	Y	N	N	N	Y	N	67	112	80	32	28.571	N	N	Y	34	Y	N	N	Y	N	112	80	32	28.571	N	Y	34	Y	N	112	80	32	28.571	N	Y	34	Y	N	112	80	32	28.571	N	Y	34
115	Vasantha	63	Female	3	N	N	Y	N	N	N	N	N	64	114	80	34	29.825	N	N	Y	34	Y	Y	Y	Y	N	114	80	34	29.825	N	Y	34	Y	N	114	80	34	29.825	N	Y	34	Y	N	114	80	34	29.825	N	Y	34
116	Ravi	51	Male	3	Y	N	Y	N	N	N	N	N	112	112	80	32	28.571	N	Y	Y	34	N	Y	Y	N	Y	112	80	32	28.571	N	Y	34	N	N	112	80	32	28.571	N	Y	34	N	N	112	80	32	28.571	N	Y	34
117	Pushpa	35	Female	2	Y	N	Y	N	N	N	N	N	85	112	78	34	30.357	N	N	Y	36	Y	N	N	N	N	112	78	34	30.357	N	Y	36	N	N	112	78	34	30.357	N	Y	36	N	N	112	78	34	30.357	N	Y	36
118	Prasanna	47	Male	2	N	N	Y	N	N	N	N	N	68	140	90	50	35.714	N	N	Y	35	Y	Y	Y	N	N	140	90	50	35.714	N	Y	35	N	N	140	90	50	35.714	N	Y	35	N	N	140	90	50	35.714	N	Y	35
119	Jaya	53	Female	2	N	N	Y	N	N	N	Y	Y	88	140	100	40	28.571	N	N	N	38	Y	N	N	Y	Y	140	100	40	28.571	N	N	38	N	Y	140	100	40	28.571	N	N	38	N	Y	140	100	40	28.571	N	N	38
120	Shanthi	56	Female	2	N	N	Y	N	N	N	N	N	120	150	110	40	26.667	N	N	Y	37	Y	N	N	N	N	150	110	40	26.667	N	Y	37	N	N	150	110	40	26.667	N	Y	37	N	N	150	110	40	26.667	N	Y	37
121	Vasugi	45	Female	2	N	N	Y	Y	Y	N	N	Y	89	138	90	48	34.783	N	N	N	37	Y	N	N	N	N	138	90	48	34.783	N	N	37	N	N	138	90	48	34.783	N	N	39	N	N	138	90	48	34.783	N	N	39
122	Veerammal	71	Female	3	N	N	N	N	N	N	N	N	84	120	88	32	26.667	N	N	N	38	Y	N	N	N	N	120	88	32	26.667	N	N	38	N	N	120	88	32	26.667	N	N	38	N	N	120	88	32	26.667	N	N	38
123	Meena	29	Female	3	Y	N	Y	Y	Y	N	N	Y	74	112	78	34	30.357	N	Y	Y	38	Y	N	N	N	Y	112	78	34	30.357	N	Y	38	N	N	112	78	34	30.357	N	Y	38	N	N	112	78	34	30.357	N	N	38
124	Prabhakaran	38	Female	3	N	N	N	N	N	N	N	N	115	128	88	40	31.25	N	N	N	36	Y	Y	N	N	N	128	88	40	31.25	N	N	36	N	N	128	88	40	31.25	N	N	36	N	N	128	88	40	31.25	N	N	36
125	Selvaraj	68	Male	3	N	N	Y	N	N	N	Y	N	88	112	80	32	28.571	N	N	Y	36	Y	N	N	Y	N	112	80	32	28.571	N	Y	36	N	Y	112	80	32	28.571	N	Y	36	N	Y	112	80	32	28.571	N	N	36
126	Raja	60	Male	3	N	N	Y	Y	Y	N	N	N	83	128	88	40	31.25	N	Y	N	39	Y	Y	Y	N	N	128	88	40	31.25	N	N	39	N	N	128	88	40	31.25	N	N	39	N	N	128	88	40	31.25	N	N	39
127	Munuswamy	58	Male	3	N	N	Y	N	N	N	N	N	115	114	80	34	29.825	N	N	N	39	Y	N	N	N	N	114	80	34	29.825	N	N	39	N	N	114	80	34	29.825	N	N	39	N	N	114	80	34	29.825	N	N	39
128	Raman	60	Male	2	Y	N	N	N	N	N	N	N	79	114	82	32	28.07	N	N	N	39	N	N	N	N	N	114	82	32	28.07	N	N	39	N	N	114	82	32	28.07	N	N	39	N	N	114	82	32	28.07	N	N	39
129	Thirupathi	64	Male	2	N	N	Y	N	N	N	N	N	76	140	90	50	35.714	N	N	N	39	Y	N	Y	N	N	140	90	50	35.714	N	N	39	N	N	140	90	50	35.714	N	N	39	N	N	140	90	50	35.714	N	N	39
130	Nandhakumar	62	Male	3	Y	N	Y	N	N	N	N	N	78	140	100	40	28.571	N	N	Y	38	Y	N	Y	Y	N	140	100	40	28.571	N	Y	38	N	N	140	100	40	28.571	N	Y	38	N	N	140	100	40	28.571	N	N	38
131	Kumar	42	Male	2	N	N	Y	N	N	N	N	N	104	150	110	40	26.667	N	N	N	38	Y	N	N	N	N	150	110	40	26.667	N	N	38	N	N	150	110	40	26.667	N	N	40	N	N	150	110	40	26.667	N	N	40
132	Manjura beevi	49	Female	2	N	N	N	N	N	N	N	N	70	138	90	48	34.783	N	N	N	39	Y	N	Y	N	Y	138	90	48	34.783	N	N	39	N	Y	138	90	48	34.783	N	N	39	N	Y	138	90	48	34.783	N	N	39
133	Surya begam	55	Female	2	N	N	Y	Y	Y	N	N	Y	71	120	88	32	26.667	N	Y	N	39	Y	N	N	N	Y	120	88	32	26.667	N	N	39	N	Y	120	88	32	26.667	N	N	39	N	N	120	88	32	26.667	N	N	39
134	Saraswathi	70	Female	3	Y	N	N	N	N	N	N	N	114	112	78	34	30.357	N	N	N	35	Y	N	Y	N	N	112	78	34	30.357	N	N	35	N	N	112	78	34	30.357	N	N	35	N	N	112	78	34	30.357	N	N	35
135	Saratha	40	Female	2	Y	N	Y	N	N	N	N	N	96	128	88	40	31.25	N	N	N	35	Y	N	N	N	N	128	88	40	31.25	N	N	35	N	N	128	88	40	31.25	N	N	35	N	N	128	88	40	31.25	N	N	35
136	Latha	59	Female	2	N	N	N	N	N	N	N	N	117	116	80	36	31.034	N	Y	Y	35	Y	N	Y	N	N	116	80	36	31.034	N	Y	35	N	N	116	80	36	31.034	N	Y	35	N	N	116	80	36	31.034	N	Y	35
137	Ellamma	65	Female	2	N	N	N	N	N	N	N	N	90	114	80	34	29.825	N	N	N	34	N	N	N	N	N	114	80	34	29.825	N	N	34	N	N	114	80	34	29.825	N	N	36	N	N	114	80	34	29.825	N	N	36
138	Radhakrishnan	75	Male	2	N	N	Y	N	N	N	Y	N	88	112	80	32	28.571	N	N	N	34	Y	N	N	Y	N	112	80	32	28.571	N	N	34	N	N	112	80	32	28.571	N	N	35	N	N	112	80	32	28.571	N	N	35
139	Syed mohammed	66	Male	2	N	N	N	N	N	N	N	N	82	116	80	36	31.034	N	N	N	38	Y	N	Y	N	N	116	80	36	31.034	N	N	38	N	N	116	80	36	31.034	N	N	38	N	N	116	80	36	31.034	N	N	38
140	Krishnan	42	Male	2	N	N	Y	N	N	N	N	N	79	138	100	38	27.536	N	N	N	39	Y	N	N	N	N	138	100	38	27.536	N	N	39	N	N	138	100	38	27.536	N	N	39	N	N	138	100	38	27.536	N	N	39
141	Vijaya	39	Female	2	N	N	N	N	N	N	N	N	113	116	76	40	34.483	N	N	N	39	N	N	Y	N	N	116	76	40	34.483	N	N	39	N	N	116	76	40	34.483	N	N	39	N	N	116	76	40	34.483	N	N	39
142	Elumalai	52	Male	2	Y	N	Y	N	N	N	N	N	89	136	86	50	36.765	N	N	N	39	Y	Y	Y	N	N	136	86	50	36.765	N	N	39	N	N	136	86	50	36.765	N	N	40	N	N	136	86	50	36.765	N	N	40
143	Bhavani	58	Female	2	N	N	N	N	N	N	N	N	98	140	90	50	35.714	N	Y	N	39	Y	N	N	N	N	140	90	50	35.714	N	N	39	N	N	140	90	50	35.714	N	N	39	N	N	140	90	50	35.714	N	N	39
144	Yasodha	54	Female	2	Y	N	N	N	N	N	N	N	101	140	100	40	28.571	N	N	Y	40	N	N	Y	N	N	140	100	40	28.571	N	Y	40	N	N	140	100	40	28.571	N	Y	40	N	N	140	100	40	28.571	N	Y	40
145	Karnal	53	Male	2	N	N	N	N	N	N	N	N	85	150	110	40	26.667	N	N	N	40	Y	N	Y	N	N	150	110	40	26.667	N	N	40	N	N	150	110	40	26.667	N	N	40	N	N	150	110	40	26.667	N	N	40
146	Murugesan	54	Male	2	N	N	N	N	N	N	N	N	100	138	90	48	34.783	N	Y	N	40	Y	N	N	N	N	138	90	48	34.783	N	N	40	N	N	138	90	48	34.783	N	N	40	N	N	138	90	48	34.783	N	N	40
147	Angusamy	72	Male	2	N	N	Y	N	N	N	N	Y	99	120	88	32	26.667	N	N	N	40	Y	N	Y	N	N	120	88	32	26.667	N	N	40	N	N	120	88	32	26.667	N	N	40	N	N	120	88	32	26.667	N	N	40
148	Ramadoss	60	Male	3	N	Y	N	N	N	N	N	N	86	112	78	34	30.357	N	N	N	40	Y	N	Y	N	N	112	78	34	30.357	N	N	40	N	N	112	78	34	30.357	N	N	40	N	N	112	78	34	30.357	N	N	40
149	Hari	43	Male	3	N	N	N	N	N	N	N	N	80	128	88	40	31.25	N	N	N	40	Y	N	N	N	N	128	88	40	31.25	N	N	40	N	N	128	88	40	31.25	N	N	42	N	N	128	88	40	31.25	N	N	42
150	Palani	75	Male	2	Y	N	Y	N	N	N	N	N	85	112	78	34	30.357	N	N	Y	36	Y	N	N	N	N	112	78	34	30.357	N	Y	36	N	N	112	78	34	30.357	N	Y	36	N	N	112	78	34	30.357	N	Y	36

ANNEXURES – V
PLAGIARISM

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AIM OF THE STUDY:
The correlation between proportional pulse pressure and ejection fraction by 2D Echo in heart failure patients.
Objectives:
1 . To study the correlation between proportional pulse pressure and ejection fraction in heart failure patients.
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2 . To study the prognostic value of proportional pulse pressure in a patient with heart failure.
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